CANADA
DEPARTMENT OF MINES
MINES BRANCH
HON. W. TEMPLEMAN, MINISTER; A. P. LOW, LL.D., DEPUTY MINISTER;
EUGENE HAANEL, PH.D., DIRECTOR

REPORT

ON THE

MOLYBDENUM ORES OF CANADA

BY

T. L. WALKER, M.A., Ph.D.

OTTAWA
GOVERNMENT PRINTING BUREAU
1911

No. 93

Frontispiece. PLATE I.

Quarry in Granite carrying Molybdenite, Cooper, Maine.

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LETTER OF TRANSMITTAL.

January 1, 1911.

Dr. Eugene Haanel,
Director of Mines,
Ottawa, Ont.

Sir:—I have the honour to submit, herewith, my report on the occurrence in Canada of ores of molybdenum. General information concerning the nature of the ores, their uses, mode of occurrence, production, and methods of concentration will be found in the introductory pages.

My best thanks are due to many engaged in the mining industry for co-operation in securing information while visiting the molybdenum regions of the Dominion.

I have the honour to be, Sir,
Your obedient servant,
T. L. Walker.

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MOLYBDENUM ORES OF CANADA.

BY

T. L. Walker, M.A., Ph.D.

PART I.

INTRODUCTORY.

Molybdenum was discovered by Scheele towards the end of the eighteenth century; but it was not isolated from its compounds until some time later. The pure metal is white in colour, and very difficult to fuse. Like iron, it takes up carbon, and the carbon-bearing alloy is more easily fused, but very much harder. Until recent years it was little in demand for industrial purposes, and very little search was made for deposits of molybdenum ores. At the present time, however, owing to its introduction into metallurgy in the form of iron-molybdenum alloys, there is considerable demand for such ores, which are produced only very irregularly, and in small quantities. If a larger and more regular ore supply were assured there is no doubt that new uses would be found for these alloys, and the demand for the ores would increase.

The present report embodies the results of observations carried on during the field seasons of 1909 and 1910. By presenting in one report all the information available regarding the molybdenum deposits in Canada, it is hoped that a new interest may be awakened in the possibilities of the Dominion as a molybdenum producing country. At present this information is much scattered; the observations were made by a large number of persons, and some of the deposits have not been examined for many years. Recently a new value was imparted to all molybdenum properties owing to the demand for ores of this metal for the manufacture of steel alloys. Deposits which had no industrial value a generation ago may now be regarded in a different light. The objective of the writer was, to visit and examine personally as many as convenient of the prominent molybdenum deposits in Canada.

Molybdenum Ores.

Molybdenite is the commonest of the ores of molybdenum and the one most widely distributed in Canada. It is a sulphide, with the formula MoS_2. In colour it resembles lead, and may on this account be confused with graphite, which is somewhat darker in colour. The specific gravity is 4·7, in contrast to graphite which is only about one-half of this density. Molybdenite has a hardness of less than 2, so that it can be scratched by the finger nail, and when rubbed on white paper leaves a mark resembling that from a lead pencil. This mark or streak is rather lighter and inclined to be greenish grey, in contrast to the blackish grey from the graphite of the lead pencil. The six sided tabular crystals of molybdenite split into very thin sheets or plates which are easily bent, but are not elastic. Occasionally this material is quite massive, and devoid of the leafy or platy structure, as is the case with molybdenite from the Giant mine, Rossland, B.C. This mineral occurs in many parts of Canada: Gabarus, in Cape Breton; Mont Cerf, in Ottawa county, Quebec; Addington county, Ontario; and at the Giant mine, Rossland, B.C.

Molybdite is a mineral which is often found along with molybdenite, from which it results by oxidation. It usually forms an earthy powder quite soft, and sulphur yellow in colour. Formerly it was supposed to be an oxide, of the formula MoO_3. Recently it has been shown to be somewhat complex, and Schaller[1] has determined it to be a hydrated iron molybdate, containing 59.42 per cent MoO_3.

Wulfenite, or yellow lead ore, is a molybdate of lead, with the formula $PbMoO_4$ with 39.3 per cent MoO_3. This material may be briefly described as follows: colour, yellow to brown; streak, almost white; specific gravity, nearly 7; hardness, less than 3 (easily scratched by the knife, but not by the finger nail); crystals, thin tablets, usually either four or eight sided. Wulfenite does not, so far as is known at present, occur in Canada in economic quantities. In Yuma county, Arizona, wulfenite is so prominent in the upper workings of some lead mines, as to be a valuable ore of molybdenum. Wulfenite and molybdite are both alteration products of molybdenite, and may, therefore, be expected in the upper levels where oxidation is relatively prominent.

General Type of Occurrence.

(*a*) Very coarse veins of granite, called pegmatite, often intersect such rocks as gneiss, slate, and quartzite. They contain various minerals of economic value, principally muscovite and feldspar. Genetically these veins owe their origin to material derived from large masses of granite, which are usually to be found in the vicinity, and which probably occur at no great distance beneath the pegmatite mass. Molybdenite is occasionally present in these veins in varying quantities, and some of the important ore bodies of Canada are of this type, as, for example, those at Romaine in Quebec and Glengarry in Cape Breton.

(*b*) Many quartz veins have originated in a method similar to pegmatite veins—the fissures have been filled by material derived from underlying, deeply-seated granite masses. Some quartz veins are almost free from feldspar, others contain so much that it is doubtful which should be designated by the first term and which by the second. In some quartz veins, particularly those containing a little feldspar, molybdenite is a casual constituent. Examples: Jordan falls, Shelburne county, N.S.; Mont Cerf, Ottawa county, Quebec.

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[1] Zeitschrift fur Krystallographie, Vol. 43, p. 331.

(*c*) In a few instances granitic rock is intersected by series of joint planes along which corrosive substances appear to have travelled. Fluorspar, quartz, and occasionally molybdenite have been deposited and are also scattered in the granite some distance from the joints. In this way the granite, over considerable areas, may be impregnated with scales and crystals of molybdenite. This type is best represented by the ore bodies at Cooper, and Catharines Hill, in Maine.

(*d*) Another type of occurrence is represented at the Giant mine, Rossland, B.C., the Marble Bay mine, Texada island, and the Harvey Hill mine, near Broughton, Que. In these mines the ore bodies are valuable for copper and molybdenite. The latter mineral is, in both instances, quite massive, and very fine grained.

(*e*) Frequently, very important deposits of molybdenite occur near the contact of intrusive granite or pegmatite with crystalline limestone. These two rock types appear to have reacted on one another, and a band of greenish pyroxene rock has been formed. In or near the pyroxenite, and frequently in the pegmatite borders, pyrite, pyrrhotite, and molybdenite are to be observed.

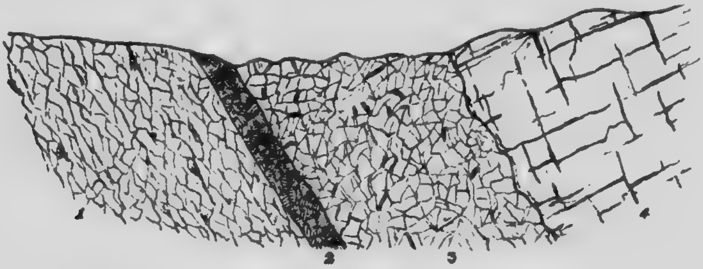

FIG. 1.—Typical form of occurrence of molybdenite.

1. Gneissoid granite.
2. Green pyroxenite carrying molybdenite.
3. Pegmatite dyke carrying molybdenite.
4. Crystalline limestone.

This type of deposit is frequent in the Ottawa valley, and is well represented by the accompanying section (Fig. 1) from a deposit in Lynedoch township, Renfrew county.

Concentration of Molybdenite.

The preparation of the crude ore for the market is one of the most difficult problems in ore dressing. Up to the present it is doubtful if a satisfactory solution has been arrived at. The mineral is very soft, and usually occurs in a very hard gangue, largely quartz and feldspar. In attempting to crush by stamps or rolls, much of the molybdenite is finely divided, so that a large loss resul by sliming. On the other hand some of the larger flakes resist the action o the rolls, and may be separated by means of sieves. In density, molybdenite i heavy enough to separate readily by washing, were it not for its perfect cleavage giving rise to very thin scales and plates, which readily float away and are lost.

In general, there are three methods of molybdenite concentration which may be applied after cobbing and hand picking:—

(1) The ore may be crushed and concentrated by washing. Mr. J. Walter Wells some years ago carried on experiments with this method of treatment in view. A brief report of the results of this work is given in the following extract[1]:—

'Experiments were carried out by Mr. Wells for the purpose of finding suitable methods for concentrating the Canadian ores. On a sample containing 50 per cent pyrrhotite, 10 per cent pyrite, and 6·5 per cent molybdenite in a gangue of calcite, biotite, quartz, and pyroxene, good results were obtained by crushing in a jaw crusher, hand picking of the large flakes of molybdenite, re-crushing in rolls set to 0·2 inch space, and successive sizings in screens from 0·3 inch to 0·5 inch mesh. The oversize from the screens, which consisted of molybdenite, mica, and rock, was treated on a Wilfley table, and yielded a commercial product. The Hartz jig was not adapted for concentrating this ore; but good results were obtained with the Wetherill magnetic separator, although, owing to the high current and slow speed necessary, it is doubtful if this separation can be done on a practical basis. Treatment by a modified form of the Elmore process was only partially successful, as the large particles of molybdenite were not affected by the oil. Another sample consisting of quartz and feldspar with 2·5 per cent molybdenite, was crushed and sized, but gave no clean ore on any of the screens. The whole sample was then ground to pass an 0·05 inch screen, and concentrated on a Wilfley table; the final concentration being effected by the oil process. The experiments carried out by Mr. Wells showed that no standard method can be adopted for concentrating molybdenum ores. Separate mill tests are required to determine the proper treatment in each case.'

(2) Crushing and dry concentration has been employed at Cooper, Maine, where the ore is granite, containing fairly coarse foliated molybdenite. The history of the concentrating operations of the American Molybdenum Company is briefly told by Mr. Hess as follows[2]:—

'The plant consisted of a 35 horse-power boiler and engine, a Sturtevant jaw crusher and roll, and four sets of special rolls, each 3 feet in diameter and 10 inches wide. The crusher was only a couple of feet above the floor, from which the material, crushed to about one-fourth inch square, was elevated to the Sturtevant roll, 18 inches in diameter by 4 inches wide, which reduced the ore to

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[1] Mineral Industry, 1903, p. 478.

[2] Hess, F. L., Bulletin No. 340, U.S. Geol. Survey.

PLATE II.

Concentrator for dry treatment of Molybdenite Ores, Cooper, Maine.

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about one-eighth inch. It was then elevated to a bin at the top of the building, from which it fell to a series of two special rolls, thence was elevated to a third special roll, and run through a 34 mesh screen. The molybdenite caught on the screen was delivered to a box at the end. The material going through the screen was carried by an elevator and screw conveyer to a fourth roll, from which it fell onto a 40 inch screen and from that to a 60 mesh screen. What went through the 60 mesh screen was elevated and sent to the tailings pile. It is readily seen that the repeated elevations of the material meant a considerable waste of power. The mill ran only six weeks, and is said to have made about a ton of concentrates, a portion of which seen by the writer was very clean. In the tailings some fine flakes of molybdenite were found, but the amount seemed small. Such a process, if mechanically perfected, might work profitably on deposits where, as in this one, the molybdenite flakes are comparatively broad, but would be wholly unsuited to deposits like many of those in Colorado and elsewhere, in which the individual flakes are of almost microscopic size.'

(3) A process apparently well suited to molybdenite ores has been recently brought forward by F. E. Elmore, and is briefly described in the following extract from an article by A. S. Elmore[1]:—

'The vacuum process for the concentration of ores, the invention of F. E. Elmore, after exhaustive test and experiment, is about to be installed on an extensive scale, many mines having given orders for large plants. The process is based primarily upon the fact that, in a flowing pulp of crushed ore and water, oil has a selective action for the metallic mineral particles as distinct from the rocky particles or gangue. This selective action is materially increased in some cases by the presence of an acid; gases dissolved in water are liberated, partially or entirely, upon subjecting the same to a pressure less than that of the surrounding atmosphere. These liberated gases may be augmented by the generation of gases in the pulp or by introduction from an external source. The gases attach themselves to the greased mineral particles, and being largely increased in volume as a result of the partial vacuum applied, cause the greased particles with their attendant bubbles of air or gas to float to the surface of the liquid.'

A London company manufactures the apparatus, and in order to demonstrate the suitability of this process for various ores, they have established a testing plant and make trial on small shipments. Three such experiments made in concentrating molybdenite resulted as follows:—

Sample Number.	Nature of Gangue.	Per Cent Molybdenum.			Per Cent Saved
		In Ore.	In Tailings.	In Concentrates.	
1	Feldspar	3·40	0·25	40·80	93·2
2	Much garnet and magnetite	2·30	0·06	51·57	98·1
3	Not stated	5·21	0·17	54·7	97·0

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[1] Elmore A. S Engineering and Mining Journal, May 11, 1907

A sample of the ore from the claims of the St. Maurice Syndicate,[1] Lake Kewagama, was treated by this process by the Denver Engineering Works Company of Denver, Colo. The sample was small, but the concentration was very satisfactory, with a minimum loss in the tailings as illustrated by the following report:—

'Following are the results obtained by the Elmore process on the sample of molybdenite submitted by Mr. J. C. Gwillim. The mineral seemed free at

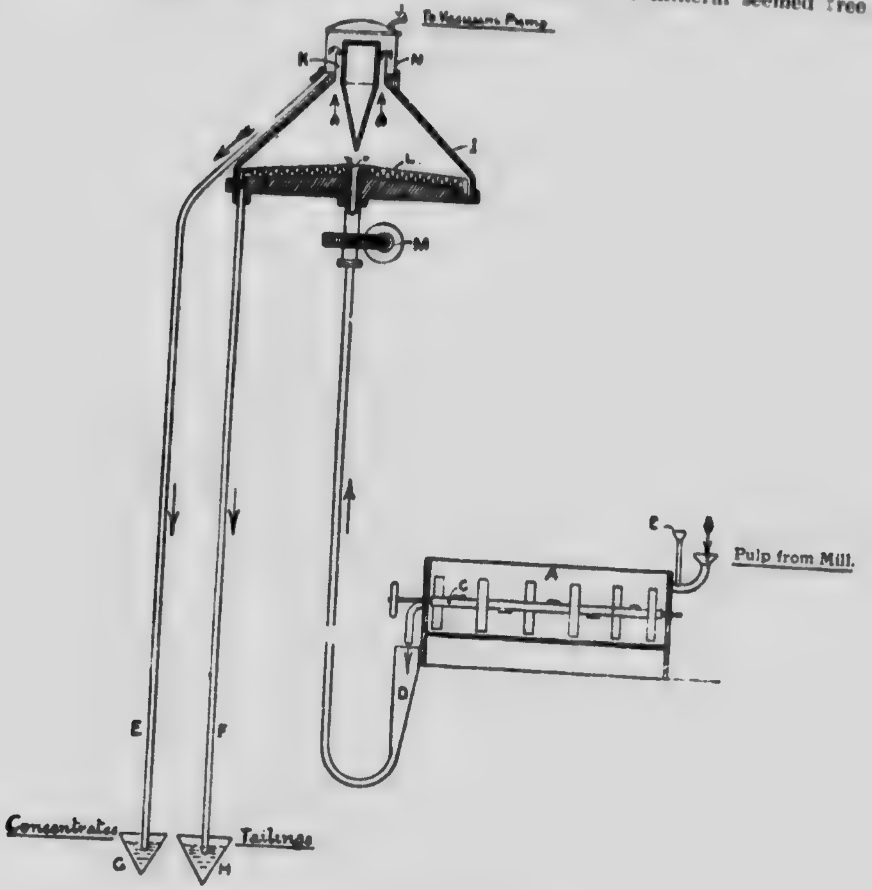

FIG. 2.—Elmore vacuum concentrator: section.

16 mesh, but owing to the small diameter of the delivery tube of the laboratory machine it was found necessary to crush it finer before making the test.

'500 grains of ore assaying 1·70 per cent molybdenum were agitated four minutes with 5 c.c. acid, 2 c.c. Beaumont oil, then four minutes more with 5 c.c.

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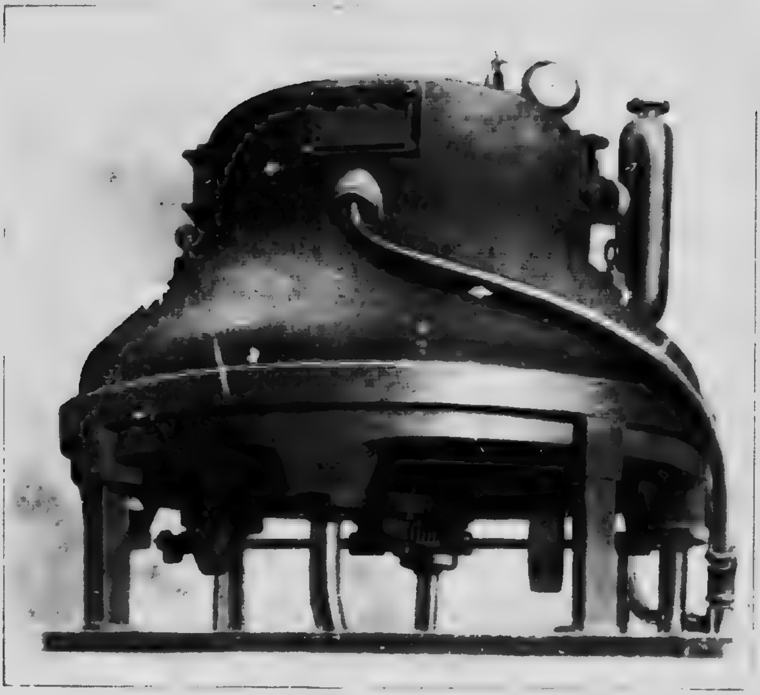
[1] Vide pp. 35-38 of this report.



Elmore Vacuum Concentrator. Capacity 35 to 45 tons per 24 hours.

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acid and 1 c.c. oil—2·5 c.c. acid were used for gas, and test was under vacuum 2·25 minutes. The following products were obtained:—

90 grains	concentrates..	42·90 per cent molybdenum.
472 "	tailings..	trace.

'This gives the ratio of concentration of 25 tons into one and a recovery of 100 per cent. The recovery figures are slightly in excess of 100 per cent owing probably to discrepancy of a few hundredths in crude assay. The tails showed acid reaction and were quite clean.

'The amounts of acid and oil used could probably be lowered very materially, but owing to the lack of time and urgent requests to rush the work these investigations were not undertaken.'

The accompanying illustrations may serve to indicate the principles involved and the type of apparatus used in this process of concentration.

At the Great Knaben mine in southwestern Norway, which has produced from 25 to 30 tons of molybdenite annually since 1902, water concentration with jigs and tables has been abandoned, and more satisfactory results are said to have been obtained by the use of the Elmore oil concentration. The ore is first cobbed, and the poorer ore sent to be concentrated.

In 1899, Professor J. B. Porter, of McGill University, made some experiments on the concentration of molybdenite for the Geological Survey. From the two samples examined he concluded that the most satisfactory method was cobbing and hand-picking.

The following extract from the Report of the Geological Survey of Canada gives the main results of Professor Porter's investigations[1]:—

'The first, or Egan Township sample, weighing 289 pounds, and containing in all 15·92 per cent of molybdenite, was cobbed and hand-picked in the Survey, yielding 39 pounds of clean mineral in crystalline flakes. The remaining 250 pounds of the cobbed ore was then sent to Professor Porter, who ascertained that it still contained 2·8 per cent of molybdenite. By a dry process of rolling and screening, followed by jigging, nearly all the molybdenite was extracted from this ore, in a series of concentrates ranging from 70 per cent to 15 per cent in molybdenite. It is not necessary to refer to the details of treatment here, but the results appear to show that in the case of molybdenite ore of this class, in which the crystalline masses are of considerable size, it would not be economically possible to employ any crushing and concentrating process. The problem resolves itself into one of cobbing and hand-picking at remunerative rates. The associated minerals in this case were: pyroxene, iron pyrites, and mica.

'The second, or Ross Township sample, weighed 250 pounds. The gangue was chiefly quartz, and, although the molybdenite made a considerable showing, it was found by Professor Porter to amount to only about one per cent. This specimen was not cobbed or hand-picked. By concentration it was determined that about 52 per cent of the molybdenite could be saved in the form of a concentrate containing 33·50 per cent of the mineral. The grade of this concentrate appears, however, to be too low for present commercial requirements.'

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[1] Report of the Geological Survey of Canada, Vol. XIII, p. 10, 1900

It is worthy of note that none of these processes has up to the present been employed very satisfactorily for the separation of molybdenite. It would seem as if a reasonable combination of the dry screening process for the removal of the coarser flakes, followed by a treatment of the tailings by the vacuum process, should give results superior to those obtainable from the employment of any one of these methods alone.

In New South Wales and Queensland, which produce a large part of the world's molybdenum ores, the molybdenite-bearing quartz is hand-picked, crushed through rolls, and then jigged. The over-size is recrushed, hand-picked again, and finally treated on Wilfley tables.[1]

For the market the ore should be concentrated to about 90 per cent molybdenite; for which, at present, the current rate is about $550 per ton. The market rate, however, is very variable. The presence of even small quantities of copper, arsenic, or bismuth, may render the ore less suitable, particularly for steel manufacture.

Uses of Molybdenum.

Until recently, molybdenum was required only for the manufacture of chemical preparations, principally ammonium molybdate, which is much used in the determination of phosphoric acid. The iron and steel works of the United States alone are said to consume as a chemical reagent several tons of molybdenum annually. Molybdic acid is used as a blue pigment in the manufacture of porcelain, and for dyeing silks and woollens. In various compounds molybdenum is used for colouring leather and rubber. Ammonium molybdate is said to be used for fireproofing, also as a disinfectant for cloth used in railway passenger carriages.

The chief use to which most of the world's molybdenum is devoted is the preparation of special varieties of steel. The result of the addition of a small proportion of metallic molybdenum to steel is very similar to that obtained by the use of tungsten. Molybdenum is more potent than tungsten, and only about half as much of the molybdenum is necessary as would be required were tungsten used instead.

Molybdenum steel is used for rifle barrels, propeller shafts, large guns, wire, and particularly for the manufacture of high speed tools. Molybdenum high speed steel contains from 8 to 10 per cent molybdenum. When the other elements exist in the right proportion, a steel is obtained of great hardness, with the peculiar property of retaining its temper when heated to a high degree, differing in this respect from all carbon steels. Owing to this property it is possible to take extremely heavy cuts at high speed, the tool often being heated through this hard use to a dull red heat without impairing its usefulness.

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[1] The Mineral Industry, 1907, p. 722.

Molybdenum Production.

The present annual world production of molybdenum ores is quite insignificant—only a few hundred tons. Norway, Queensland, New South Wales, Japan, and the United States, are the chief producing countries. In all of these the output is much subject to rapid variation.

In Canada there has been no regular production of molybdenum ores up to the present time. So far as I have been able to learn, the following are the chief returns on the subject:—

(1) The production of 150 pounds of molybdenum is listed in the mineral statistics for 1886. The place where the ore was mined is not indicated. This appears to be the first appearance of molybdenum in the mineral statistics of Canada.[1]

(2) In 1902 about 4 tons of molybdenite bearing ore valued at $400 were mined in the township of Laxton, Victoria county, Ontario.[2]

(3) In 1903, 85 tons of crude ore containing about 4 per cent molybdenum were mined in the east half of lot 5, concession XIV, in the township of Sheffield, county of Addington, Ontario. About 500 tons of rock had been blasted out in order to obtain this ore; so that the ground as broken contained less than one per cent molybdenum.[3]

(4) In 1894, in the township of Aldfield, in the county of Pontiac, the Foote Mineral Company of Philadelphia carried on operations, not with a view to producing molybdenite in a commercial way, but to securing specimens for museums and for teaching purposes. The amount of molybdenite obtained was very small.

(5) During the summer of 1909, Lieut.-Col. John Carson and associates, of Montreal, carried on explorations near Romaine, on the north shore of the Gulf of St. Lawrence. They made at least one shipment of about 2 tons of ore. This was shipped as samples, and for experiments in concentration.

With regard to foreign production, it is equally difficult to obtain satisfactory statistics, as the amount involved is small and the production spasmodic. In recent years Queensland and New South Wales have become relatively large producers.

The following imperfect statistical tables present all the data available:—

QUEENSLAND MOLYBDENITE PRODUCTION.

Year.	Amount	Value.
	Tons.	£
1900	11	561
1901	26	1,609
1902	38	5,229
1903	11	1,321
1904	21	.....
1905	.....	
1906	145	17,034
1907		
1908	89	9,239

---

[1] Report of Geol. Survey of Can., Vol. II, p. 78, 1887.
[2] Report of the Bureau of Mines, Ont., Vol. XII, p. 24, 1903.
[3] Report of the Bureau of Mines, Ont., Vol. XIII, 1904.

The total production from 1860 to 1908 inclusive, is stated to be 583 tons, 11 hundred weight, valued at £64,352.

NEW SOUTH WALES MOLYBDENITE PRODUCTION.

Year.	Amount.	Value.
	Tons.	£
1902	15	1,841
1903	29	4,458
1904	25¼	2,726

Since 1902, Norway has produced from 25 to 30 tons of molybdenite per annum. Part of this is hand cobbed, and the rest is concentrates. Most of the Norwegian molybdenite is from the Great Knaben mine in the southwestern part of the country. The ore is quarried where it forms impregnations of molybdenite scattered through the granite, but in other places quartz veins are regularly mined by underground workings.

PART II.

MOLYBDENUM IN CANADA.

NOVA SCOTIA.

The first records now available as to the distribution of ores of molybdenum in Nova Scotia are contained in How's Mineralogy of Nova Scotia, published in 1868. The localities there mentioned are as follows: Gabarus in Cape Breton; Hammond Plains and Musquodoboit in Halifax county, and Chester in Lunenburg county.[1] In all the counties mentioned molybdenite is known to have been found, in drift in Halifax county, and *in situ* in the other two.

Since 1868 these ores have been found in several other localities, so that at present they are known from the following places:—

(1) Yarmouth county, Chegoggin point, about 4 miles north of Yarmouth (G. . Hoffmann, Catalogue of Section of the Museum, Geological Survey of Canada, 1893, p. 60.);

(2) Shelburne county, north of Jordan falls;

(3) Lunenburg county, near New Ross, in place and also in quartz boulders;

(4) Halifax county, in boulders near Bedford;

(5) Cape Breton county, Gabarus bay, and also on the Gaspereau River road;

(6) Victoria county, north River St. Ann (Authority same as for No. 1.)

From none of these localities has molybdenite been shipped in a commercial way up to the present time, but it is possible that some of the prospects may, as a result of development, become mines.

JORDAN FALLS, SHELBURNE COUNTY.

The country rock for this region is staurolite schist, resulting probably from the metamorphism of slate rocks by intrusive granite. There are numerous areas of biotite granite in this county, and they are probably accountable for the metamorphism. This granite is cut by very regular pegmatitic quartz dykes, rich in black tourmaline, as may be seen in the quarry southwest of Shelburne. The rock formation around Jordan falls and for some miles northward is of the metamorphic type referred to. It is intersected by veins and stringers of white milky quartz, carrying black tourmaline. For at least twenty years these quartz veins have been known to many in Shelburne to carry molybdenite. They have been examined frequently from an economic point of view, but so far as can be learned, no attempt has ever been made to obtain the right to mine, and up to the present no development work has been done. Dr. W.L. Bailey[1] reports examining such a quartz vein carrying molybdenite in the bed of a brook about 6 miles north of Jordan falls.

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[1] How, Mineralogy of Nova Scotia, 1868. p. 61.

On visiting this region I examined the beds of numerous brooks as these were crossed in following the wagon road northward. Along Threemile brook, just to the west of the road, white quartz boulders are scattered; while on the south side of the stream the quartz may be examined in place. The vein had a northeast-southwest strike, and while very variable in its size, reached a width of 2½ feet. In the quartz are contained black tourmaline, plates of ilmenite, and an occasional small scale of molybdenite. It is reported that along the strike of this vein, to the northeast, a similar outcrop of quartz carrying molybdenite has been observed.

None of the deposits at present known seem to have any commercial value, but there is a possibility that prospecting might bring to light quartz veins carrying economic proportions of molybdenite.

It is of interest to note that cassiterite or tinstone has been found in the gravels from some of the streams of Shelburne county. This is probably derived from some of the tourmaline bearing quartz veins and may owe its origin to the action of gases and vapours which escaped from the immense granite masses at the time of solidification, acting on the country rock as it escaped to the surface. Cassiterite, tourmaline, and molybdenite commonly originate in this way.

CHESTER DISTRICT, LUNENBURG COUNTY.

In the vicinity of New Ross, 16 miles north of Chester basin, ores of molybdenum, tungsten, and tin have been discovered in several places. The region is occupied by granite rocks, usually biotite bearing, but in some parts, characterized by the presence of the white mica or muscovite. In certain places, as for example near Lake Ramsay, the granite is cavernous and in the caverns fluorite has been deposited, partly filling in the open spaces. This granite is quite fresh. In colour the fluorite is dark purple or at times almost black. From the frequent occurrence of the ores of tin, tungsten, or molybdenum, coupled with the cavernous granite carrying fluorite, we may conclude that this region has been subjected to what is known as pneumatolitic action—the action of corrosive gases and vapours escaping from great igneous masses of granite.

In 1868, How reported molybdenite as occurring in Chester. Only one of the localities at present known in Chester was discovered at this early date. About 3 miles east of New Ross on the Windsor road, in fields belonging to Mr. Bennett Walker, numerous boulders of milky white quartz containing molybdenum are found. Mr. Walker informs me that these have been known for at least forty years, so that it is probable that How's Chester specimens were obtained from this locality. The molybdenite, as seen when the place was visited in June, 1909, forms thin plates, sometimes exhibiting hexagonal boundaries.

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[1] Report of the Geological Survey of Canada, 1896, p. 146 M.

They vary in size from ⅛" to ⅜" diameter. The mineral is scattered irregularly through the rock mass. A little decomposed orthoclase accompanies it. The boulder examined has been broken and much of the best ore taken away. Mr. Walker informs me that similar boulders have been frequently found in a belt a couple of miles long and only a few hundred feet wide, the main extension being north-northwest. These boulders have possibly been torn loose from the solid vein rock, and scattered in this way by glacial movement, which was here from the north-northwest.

About twenty years ago, Messrs. Chas. Keddy and P. Lantz obtained mineral rights for an area west of New Ross and about 1½ miles south of the Annapolis road. The valuable mineral was molybdenite which was contained in grey muscovite granite of medium grain. The granite is broken by joints nearly vertical and northeasterly in direction. Parallel to one of these occurred a mineralized zone or vein said to have been from ½" to 2½" across. This was rich in molybdenite. The rock contains a little purple fluorite. Many years ago a pit 10 feet deep was sunk on the vein, but in June 1909 it was full of water so that only the surface geology and the character of the refuse could be studied. The granite is impregnated with spots and scales of molybdenite for some distance from the main vein. Most of the rocks picked up from the dump contain more or less of the ore. No surface trenching has been done, so that the extent of the mineralized area is not known. This occurrence in which the molybdenite becomes, as it were, a regular rock constituent, resembles in this regard some of the most promising deposits of the State of Maine, as described by Frank L. Hess.[1]

As only the refuse of the operations carried on nearly twenty years previous could be examined, it would be unfair to speak of the possibilities of this deposit—it certainly has a great advantage if the granite should be found to contain the ore in economic proportions. In most of the other Canadian deposits the molybdenite is sharply confined to the veins, and does not extend into the rock mass.

The third occurrence of molybdenum ores lies about 2 miles northwest of the one just described. It belongs to a small syndicate at present, one of the partners being Charles Keddy, of New Ross. On this claim considerable work was done during the summer of 1907. The country rock is muscovite granite containing dykes and irregular masses of extremely coarse pegmatite. The molybdenum minerals in the form of molybdenite and molybdite were present in extremely small proportions, and as far as known are of no economic value. The following paragraph indicates the chief mineralogical features:—

'From the results of Mr. Johnston's determination up to date, the following minerals have been found to occur in the granites at New Ross: cassiterite, monazite, one of the columbite minerals, durangite, amblygonite, a lithium mica probably lepidolite, wolframite, scheelite, hübnerite, molybdenite, pyrolusite, manganite, limonite, hematite, magnetite, siderite, bismuthinite, argentiferous galena, copper, iron and arsenical pyrites, kaolin and firecla crystals of black, smoky quartz, large crystals of white, smoky quartz, some which measured 27 inches long by 10 inches thick."

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[1] Hess, Frank L., Bulletin No. 340, U. S. Geol. Survey, 1907, p. 231.

MOLYBDENUM IN HALIFAX COUNTY.

As far as the writer has been able to learn, there is no information at pr sent available to indicate where ores of this metal may be found in place Halifax county. How[2] refers to Hammond Plains and Musquodoboit places where molybdenite is found. No other information is available as to th latter occurrence—it may be that the deposit which was known to How has bee forgotten. The boulders were probably derived from localities in this count but up to the present no such deposit has been definitely located.

CAPE BRETON COUNTY.

For more than forty years it has been known that molybdenite was to b obtained from the rocks in the vicinity of Gabarus bay, in Cape Bret county,[3] a few miles to the west of the old fortification of Louisburg. Th north shore of Gabarus bay is very rocky, and the chief rock type is brown to gre in colour, very fine grained, with a slight parallelism. As one examines it i the field it appears to be a fine grained volcanic, possibly a felsite. In th vicinity of Eagle Head the parallelism—flow structure—is vertical, and strike north-northeast. Numerous stringers of quartz traverse the rock mass. They appear to belong to two systems. The heavier system of stringers follows the parallelism of the rock mass. These stringers do not appear to carry away minerals of economic value. The other system of quartz stringers is nearly horizontal, and dips about 20° to the north. These stringers are usually narrow, and commonly are not more than ½" in thickness. According to Mr. Harry Piers, of the Provincial Museum, Halifax, to the west of Eagle Head these quartz bands sometimes attain a thickness of 2" or 3". The thickness of felsite between the quartz bands is usually several feet, so that the proportion of quartz mass is very small. Mineralogically the quartz is the most prominent constituent. Black, shining, cleavable hornblende and molybdenite in scaly masses and individual six-sided crystals are the chief accessory minerals. The distance along the shore over which these molybdenite bearing quartz veins are scattered has not been determined. The best localities appear to be in the vicinity of Eagle Head—extending half a mile east of the point, and possibly the same distance to the west.

No attempt has ever been made to win the molybdenite for commercial purposes. The quartz stringers carry the ore only occasionally, and they make up only a very small proportion of the rock mass. The felsite would be a very hard rock to quarry.

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[1] Summary Report, Geological Survey of Canada, 1907, pp. 81-82.
[2] How, Mineralogy of Nova Scotia, p. 61.
[3] How, Mineralogy of Nova Scotia, Halifax, 1869, p. 61.
[4] Fletcher, Geol. Survey of Can., 1877-78, p. 29; 1875-76, p. 416.

The second molybdenite deposit in Cape Breton county lies about 4 miles southeast of Big pond, on the Gaspereau River road, near Glengarry post-office. It is easily reached from Big pond, as it occurs quite close to the road, on the north side, on Murdock McKinnon's farm. Beyond a few shots of dynamite no development has been attempted.

The best exposure occurs in the bed of a very rapid brook, so that the loose material has been swept away, and good natural exposures are available for study.

An examination shows an alternating series of bands of red granitic rock and a much crushed slickensided dark rock, probably a pressed shale or slate. The granite bands vary from 2 feet to several yards across. The other rock is represented by narrower bands. The strike of this complex is west-northwest, and the dip 70° north.

The red granite rock contains very little besides the feldspar and quartz, and would ordinarily be called a fine grained pegmatite. In this rock molybdenite is seen in the form of occasional masses of a few grammes weight. The mineral is not so scaly as at Gabarus. Owing to its being very easily reached many persons have visited this place and the best specimens have been removed. The molybdenite, which occurs in the granite as small spots and grains, is not very abundant.

According to Mr. McKinnon this deposit was discovered by his brother about forty years ago. It has been briefly referred to by Mr. Fletcher in his reports on Cape Breton.[1] For some time it was known as a black lead mine, and is so indicated on Church's map of Cape Breton county. Mr. A. Morrison, of Big Pond, is interested in the mineral rights of this deposit.

NEW BRUNSWICK.

It has been known for many years that some of the quartz veins which are numerous in the vicinity of the confluence of Burnt Hill brook and the Main Southwest Miramichi, carry promising amounts of molybdenite. The region was visited in September, 1910, and some of the veins were examined.

The rocks of the region are entirely made up of dark slate, which has been altered probably by the influence of large igneous masses of granite, and which is seen a short distance down stream, and whose general distribution is indicated on the accompanying sketch map. It will be observed that the quartz veins carrying the molybdenite and wolframite intersect the altered slates. The ore bearing regions are seldom more than a mile from the granite contact as shown on the map. Measured vertically, it is probable that the granite is still nearer. The veins which reach a thickness of 2 feet are practically free from pyrite and chalcopyrite. The molybdenite forms scales and crystals, but does not appear to be present in very large proportion.

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[1] Report of Progress, Geol. Survey of Canada, 1876-77, p. 452.

During the investigation of these veins it was discovered that wolframi (a valuable ore of tungsten) frequently accompanies the molybdenite in t quartz. The crystals of wolframite are at times quite large—one measurin 2" long, 1½" wide, and ½" thick. Generally, the wolframite was most abunda in the quartz towards the border of the veins. The mineral had not been know to occur in this region, and the deposits may be developed for wolframite, whic mineral offers more encouragement than the molybdenite. The veins richest i wolframite are found southeast of the confluence of the two rivers. Some ar quite near the south bank of the main stream, and others about half a mil distant.

At the time the property was visited no development work had been done but since then it is understood that Messrs. M. Lodge, of Moncton, and Samue Freeze, of Doaktown, are opening up some of the best deposits for wolframite.

In addition to the above-mentioned locality, the reports of the Geological Survey of Canada contain several references to the occurrence of molybdenite in New Brunswick. The following may be briefly mentioned:—

(1) Charlotte county, near Gaspereau station, and in the parish of Pennfield on Trout brook, 2 miles north of the old post road.

(2) Gloucester county, near Bathurst on the Nipisiguit river.

QUEBEC.

NORTH SHORE OF THE ST. LAWRENCE.

The first account of the occurrence of ores of molybdenum on the north shore of the St. Lawrence is contained in the Geology of Canada published in 1863.[1] On pages 503 and 754 of this report the following statements are found:—

'Molybdenite, or sulphuret of molybdenum, has been observed in small quantities in a quartz vein at Terrace cove on Lake Superior. It has also been several times met with associated with pyroxene on Mud lake, in the vicinity of Balsam lake, in one case accompanied with copper pyrites and quartz. It also occurs sparingly in flakes in a reddish gneiss at St. Jerome. The only locality in which this mineral has been observed in considerable quantity is at the mouth of the Quetachu river, in Manikuagan bay, on the north shore of the Gulf of St. Lawrence. Here, in a bed of quartz 6 inches thick, in gneiss, molybdenite occurs in nodules of from 1 to 3 inches in diameter, and in flakes, which are sometimes 12 inches broad, and one-fourth of an inch thick.'

'On page 504, several localities of molybdenite have been mentioned; but the only one of them, so far as known, which affords any available quantity of

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[1] Geology of Canada, 1863, Montreal.

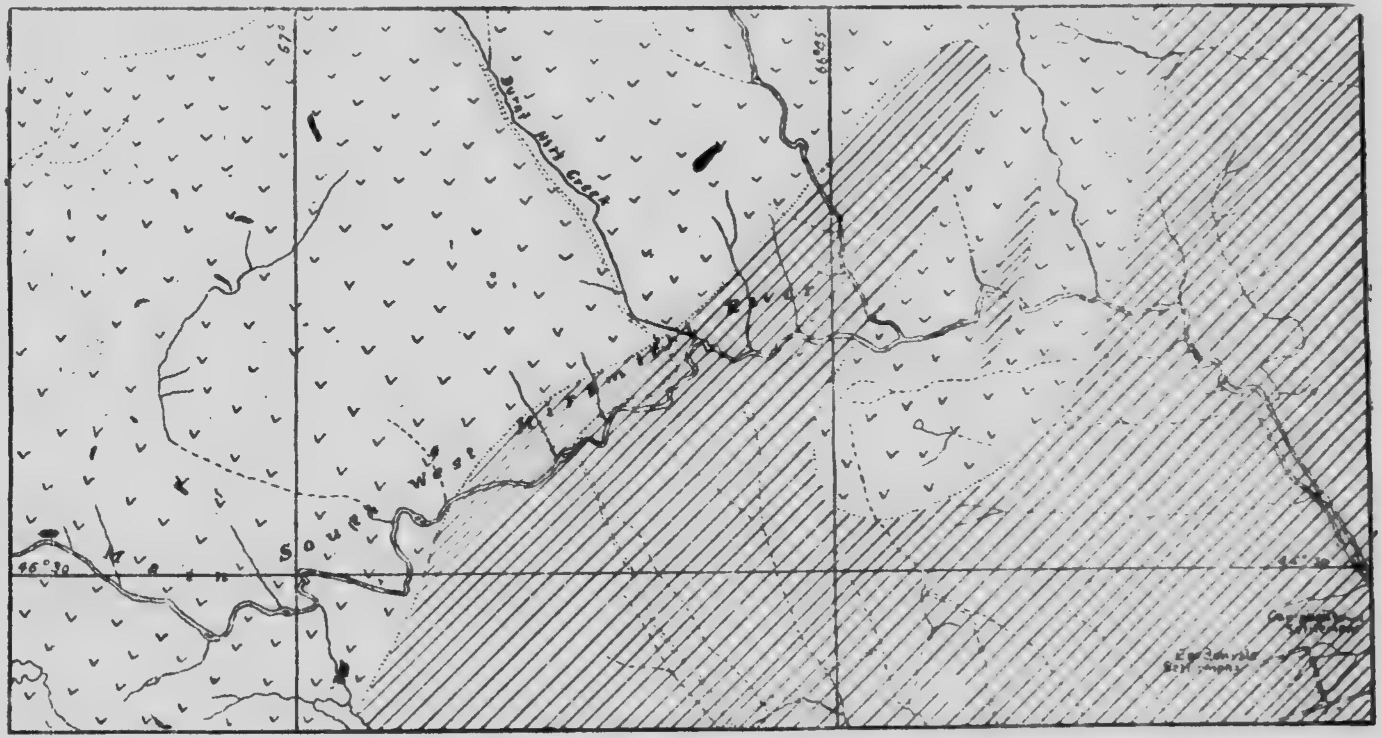

FIG. 3. Sketch map showing the geological relations of the region around the confluence of the main stream and Burnt Hill creek where ores of molybdenum and tungsten are found. Parallel lines indicate the area of the slate. The other formation represents the granite. Scale 4 miles to 1 inch.

the mineral, is that described as occurring in Quetachu-Manikuagan bay, o the north shore of the Gulf of St. Lawrence; where it occurs disseminated in bed of quartz 6 inches in diameter; and in flakes which are sometime 12 inches broad by one-fourth of an inch in thickness. The bed, which is interstratified in a white coarse grained gneiss, holding garnets and black mica was traced about fifty yards, with a dip N 15° E <58°, and would probably furnish a considerable quantity of molybdenite.'[1]

It does not appear that any further contributions to our knowledge of this subject were rendered until the publication of a report of the explorations of the late Mr. H. de Puyjalon in 1883, from which the following extracts are taken:—

'Two and a half miles above Watshishu river, on the east side of the cape which forms the eastern boundary of the Bay of Quetachu-Manikuagan, I again found the molybdenite spoken of twenty-five or thirty years ago by the explorer of the Canadian Geological Survey.

'The molybdenite which I found at Quetachu is interbedded in a vein of quartz, 6 to 18 inches thick, but, instead of crossing the white, coarse grained gneiss, it cuts through a black rock, resembling a highly micaceous greissen which seems to be of eruptive origin. Along the course of the vein the sides of the greissen in contact with it have been altered and become schistose. The nodules of the sulphuret of molybdenum are laminated, and some of them quite visibly crystalline hexagonally. Their dimensions vary from 1 to 3 inches.

'This vein cannot be the same as that referred to in the Geology of Canada. The vein found by the English explorer must follow the one discovered by me. It is probable that the place examined twenty-nine or thirty years ago has been covered up by sea-weeds or moss and by ponds formed by the accumulation of rain water and melted snow in the large depressions which sometimes occur in the white coarse grained gneiss.'[2]

In the later report[3] Mr. de Puyjalon refers frequently to the occurrence of molybdenite along this shore. As his reports are not very well known or readily accessible, the following extracts may be useful:—

'I also found in Victor bay some isolated crystals of molybdenite in short veins of quartz traversing or running parallel to outcroppings of feldspar (p. 266).

'On the eastern point of this same bay, designated on Bayfield's chart as Point Quetachu-Manikuagan, there are:—

'Firstly: two veins of compact quartz, about 6 to 7 inches wide, with about the same direction and both containing nodules of molybdenite. One of these veins, noted by the Geological Survey of Canada, contains nodules of 3 to 12 inches in length, by 2 to 4 inches in width and traverses a coarse grained white gneiss. The other, less rich in appearance, but undoubtedly very close to the first, traverses very compact and deep black mica-schists (p. 267).

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[1] Geology of Canada, Montreal, 1863, p. 755.

[2] Report of the Commissioner of Crown Lands, Quebec, 1883, p. 136.

[3] Report of the Commissioner of Colonization, Quebec, 1898, pp. 264-276.

'From Little Muskwaro to Washikuti, crystalline rocks of the same nature extend without interruption. To the east of the harbour of Washikuti in a pretty fine grained gneiss rock, I found a vein of quartz 3 to 4 inches wide, containing nodules of molybdenite from one-half inch to 1 inch in diameter (p. 270).

'At the western end of one of these islets, which constitutes the harbour of the fishing boats of Olomanoshibo, I met a vein of calcite containing a slight quantity of graphite, and a little farther, to the east, on another island, from a feldspathic vein traversing the mica-schists, I picked up a nodule of molybdenite 2 inches long, 1 inch wide, and 1 inch thick. From Olomanoshibo to Wolfe bay, the rocks of the formation do not vary, or very little. They present always the same crystalline character. Thus far, I have found nothing useful in them, except some very handsome ornamental granitic stones. Nevertheless, the accidental minerals found in the preceding rocks must be equally there.

'Very close to the entrance of Mekattina river, to the east and 1½ miles from the mouth of that river, there is a vein containing molybdenite (p. 271).

'If, on leaving Mekattina river, an eastern direction is taken, you pass through a series of innumerable islands and islets, which extend for a distance of 6 or 8 miles. A number of these islands contain nodules of magnetic iron, nodules of molybdenite and yellow pyrite, but it would be impossible for me to indicate in such a jumble of rocks the precise position of these deposits, which moreover did not appear to be abundant.

'By trending a little to the north, when the eastern limit of this complicated archipelago has been about reached, you arrive at the entrance of a very long and very rocky bay, situated about 3 miles west of Cape Mekattina and at the bottom of which empties a pretty little stream, designated under the name of Ben Reed's river. On the eastern side of the river, and not far from the first falls, there is a vein of molybdenite. The impregnations of yellow pyrites are also clearly visible on the rocks bordering the banks of this water course.

'Ha Ha bay is rich in ornamental rocks, but I noticed in them nothing but pyrite in small quantity, and in a patch of quartzose feldspar, a very small hexagonal crystal of molybdenite.' (p. 272).

The accompanying sketch map of part of the country adjacent to the Gulf of St. Lawrence indicates the position of most of the places named and of many of the molybdenite discoveries mentioned.

The occurrence of molybdenite in the Province of Quebec was reviewed by Mr. Obalski, late inspector of mines, in the reports of 1897 and 1898.[1]

The writer visited only two of the localities on the north shore: the peninsula southeast of Quetachibo-Manikuagan bay, and part of the island near Olomanoshibo, generally called Romaine. The deposits at both these places have been taken up by parties interested in their development, and at Romaine active prospecting operations were in progress.

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[1] J. Obalski, Report of Mining Operations in the Province of Quebec. 1897, 1898.

On the east side of the peninsula which lies to the east of Quetachu-Manikuagan bay, molybdenite occurs in a vein of white rock resembling quartz, but which a closer examination shows to be made up almost entirely of feldspar. The general rock of this peninsula is very coarse pegmatite, interbanded with heavy beds of a very dark gneissoid rock in which biotite and hornblende are prominent. The general strike of the bands is about northeast. On the southwestern part of the peninsula the coarse pegmatite forms nearly the whole of the rock mass, while to the east the dark rock is somewhat more abundant.

The feldspar is usually pink in colour, and intergrown with soda-lime feldspar, giving rise to perthite; or, at other times, it is intergrown with quartz in the form known as graphic granite. Apart from the types just mentioned the pegmatite mass contains a little quartz, scales of black mica, streaks of black tourmaline and of small red garnets. Mining rights on this peninsula have been obtained by Mr. Peter McKenzie and associates, of Montreal, who propose to open quarries for feldspar to be used in the porcelain industry.

On the eastern side of this peninsula, only a few yards from the water's edge, occurs a white molybdenite bearing vein of quartz and feldspar from 4" to 1 foot in thickness. It has the general northeasterly strike of the country rock, and dips to the southeast under the water. It can be readily followed for nearly 100 yards. This vein occurs in the dark gneissoid rock and not in the pegmatite. Logan describes a bed of quartz occurring in 'white coarse grained gneiss,' and on this ground de Puyjalon concluded that the vein which he described was not the same as Logan's, because the one occurred in white coarse grained gneiss, and the other was found in a dark rock, almost an amphibolite. The peninsula is so well exposed, and as nobody has seen more than one vein, it seems to be almost certain that Logan and de Puyjalon refer to the same vein or bed carrying molybdenite. All who have visited this place have broken off pieces of white vein rock carrying molybdenite and taken them away so that at the time the deposit was visited no very large masses of molybdenite were to be seen. Flakes and masses 1" in diameter were to be seen scattered through the white milky vein rock, constituting possibly 5 per cent of the whole vein matter. The so-called quartz is practically free from other minerals. As will be apparent on considering the hardness of the country rock, and the size and richness of the vein, this deposit cannot be profitably worked for molybdenum unless the market price is extremely high. There are, however, chances of this vein improving with depth, and of the discovery of other veins in the vicinity.

Quetachu-Manikuagan is at present most readily reached by taking one of the steamers from Quebec to Esquimaux Point, and then travelling the remaining 35 miles in a fisherman's sail-boat.

Near the mouth of the Olomanoshibo river, about 100 miles east of the deposits just referred to, there are numerous rocky islands whose shores have been washed bare by the sea. On two of these prospecting for molybdenite has been undertaken by Colonel Carson and associates, of Montreal. At the time of our visit eight or ten men were engaged in this work, and two tons of

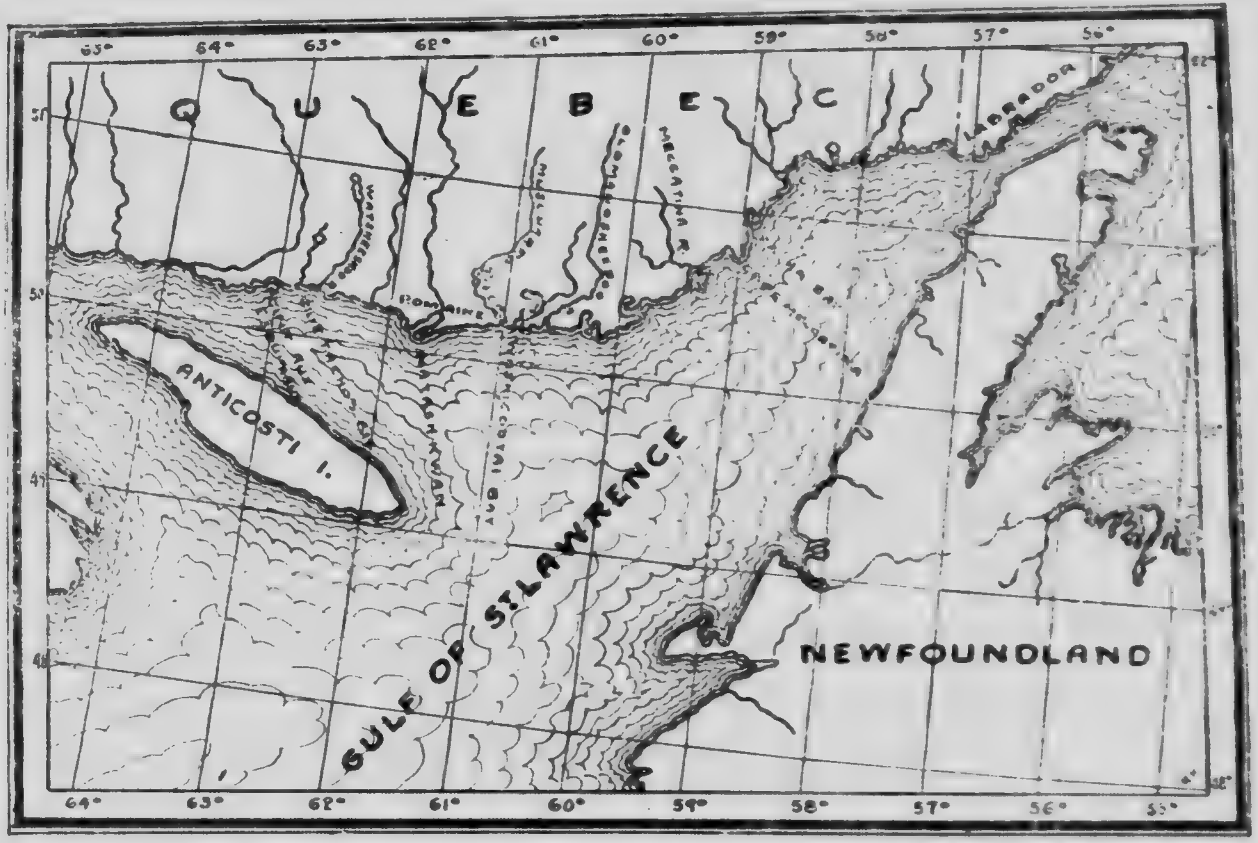


Fig. 4.—Map of a portion of the north shore of the Gulf of St. Lawrence, showing the position of the chief [illegible]

ore [illegible] sinking test pits, were shipped as samples to be assayed and sub- [illegible] ments in concentration. This ore was obtained from McKenzie [illegible] miles west-southwest of the Hudson Bay post.

McKenzie island is made up of grey mica sillimanite gneiss (strike NW-SE, dip nearly vertical) interbanded with strings of intrusive pink pegmatite. These bands are much curved and do not follow a straight line, though their general strike agrees with that of the gneiss. Some of these bands are more quartzose than the rest, and they seem to be the carriers of molybdenite. The ore generally occurs as leafy concretions on the border of these pegmatite stringers. Near the shore one such band was shown by a series of test pits to extend at least 200 feet. Its width varied to a maximum of 8". Adjacent to the ore band the gneiss carried numerous needles of sillimanite with an occasional small leaf of molybdenite. Traces of chalcopyrite and pyrite occur along with the ore.

The accompanying photograph indicates the relationship of the country rock to the subordinate pegmatite intrusion, and also the distribution of molybdenite in the vein mass. Pieces of pure massive molybdenite, as large as walnuts, are occasionally found.

At the time of my visit the operators were engaged in prospecting the other islands along the shore for deposits similar to that which had been tested on McKenzie island.

In preparing a sample of the Romaine ore for assay it was found that a considerable portion of the molybdenite remained upon the sieves. Three portions were assayed separately with the following result: (Analyses by Norman G. Madge, University of Toronto).

(1) 3,855 grams which had passed through 40 mesh were found to assay ·89 per cent molybdenum, corresponding to 1·48 per cent molybdenite.

(2) 143 grams caught on the 40 mesh yielded on analysis 12·82 per cent molybdenum, corresponding to 21·37 per cent molybdenite.

(3) 108 grams caught on the 30 mesh gave the following result:—

Molybdenum.	34·06 per cent.
Sulphur.	23·12 "

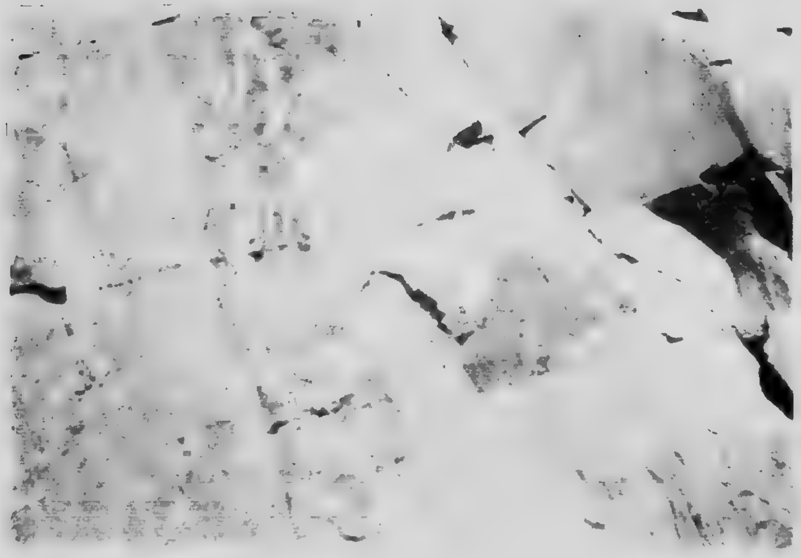
This corresponds to 56·76 per cent molybdenite. The last sample was examined and found to be quite free from arsenic, antimony, bismuth, and copper, substances whose presence frequently lessens the value of molybdenum ores.

It may be readily calculated from the above data that the ore sample as a whole contained 1·89 per cent molybdenum or 3·15 per cent molybdenite.

This ore was very leafy, and would be more suitable for dry concentration than most Canadian ores. Its freedom from arsenic, antimony, bismuth, and copper, should give it an advantage.

One sack of the ore shipped from Romaine by the gentleman prospecting McKenzie island, was kindly forwarded for examination, and the above assays were made on this material.

PLATE IV.



Pegmatite Stringers in Gneiss, Romaine, North Shore of the Gulf of St. Lawrence.

PLATE V.

Old Concentrator of the Harvey Hill mine, Broughton, Que.

274—p. 28.

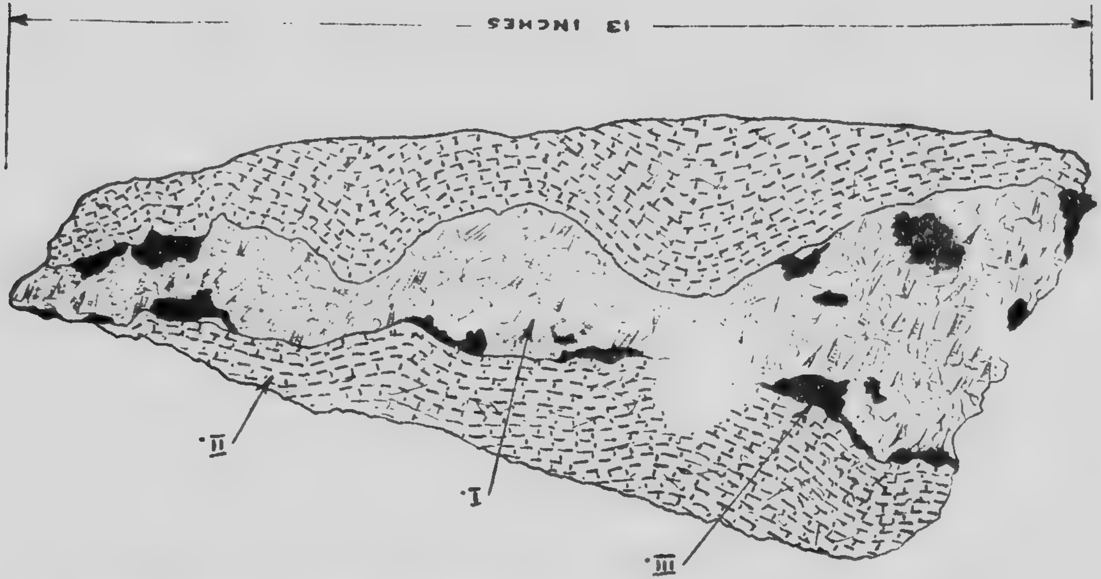


Fig. 5. — Molybdenite along the border of pegmatite in sillimanite gneiss, Romaine, north shore of the Gulf of St. Lawrence.
I. Pegmatite. II. Gneiss. III. Molybdenite.

NORTH OF THE OTTAWA.

The region to the north of the Ottawa river is largely occupied by metamorphic rocks—gneiss, crystalline limestone, and schists—frequently intersected by igneous intrusions of granite, syenite, or gabbro. For many years it has been known that throughout this region molybdenite is of frequent occurrence. Some of the deposits have been generously referred to as mines, though in fact no serious attempt has ever been made to operate any of them. Here and there a few shots of dynamite have been employed, but as a rule, the primitive condition has not been disturbed. The accompanying sketch map indicates the position of the chief of the molybdenite 'mines.'

Egan Township, Lot 69, Range IV.—This prospect is referred to by Obalski[1] as one worthy of attention. The writer examined it in August, 1909. It is located 80 miles north of Ottawa, in the valley of the Gatineau, near Mont Cerf, 18 miles north of Maniwaki station. The country rock is of the metamorphic gneiss-schist complex. The rocks strike in a general northeasterly direction. Crystalline limestone is prominent, and occurs quite near the deposit, which has the form of parallel stringers, in green pyroxene rock. Along with scales of molybdenite which forms crystals, at times 2" diameter, one observes pyrite, pyrrhotite, phlogopite, molybdic ochre, and green pyroxene. The two chief stringers are 6 to 8 feet apart as exposed in a prospect pit 10 feet deep, and 20 feet long. The outcrop is on a steep hillside, and a tunnel has been driven into the hillside some distance below the outcrop with a view to cutting across the deposit. After the tunnel had been driven 80 feet, work was suspended before the deposit was reached. It was from this deposit that one of the ore samples used in the concentration experiments carried out in the McGill laboratories was obtained.[2] No machinery has been installed. Mr. Eugene Lafleur, of the Public Works Department, Ottawa, is one of the proprietors. This is on the whole the most promising molybdenum property in the Gatineau region.

Alleyn, Lot 1, Range 11.—On the land of Mr. H. Heeney, a quartzose dyke of pegmatite cuts hornblende gneiss which strikes east and west with a vertical dip. The property is not developed, and up to the present it gives little promise. In addition to molybdenite there is also a little molybdite.

Aldfield, Lots 1 and 2, Range III.—On the farm of Norbert Genereux, some 15 miles west of Wakefield, there are hills which contain considerable masses of greenish pyroxene rock, which in turn contains irregular masses of sulphides, principally pyrite, pyrrhotite, and molybdenite. The sulphides seem to follow joint planes through the rock, which, for some distance, is impregnated with molybdenite. The molybdenite crystals are at times completely enclosed in the pyroxenite—at other times more intimately associated with the pyrite and pyrrhotite. Frequently, the sulphides owing to oxidation, have given rise to rusty decomposition products.

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[1] Sessional papers (No. 21) 1899, Quebec.
[2] See chapter on Concentration, p. 11.

Some years ago the Foote Mineral Company of Philadelphia carried on explorations here with a view to securing good specimens of molybdenite for

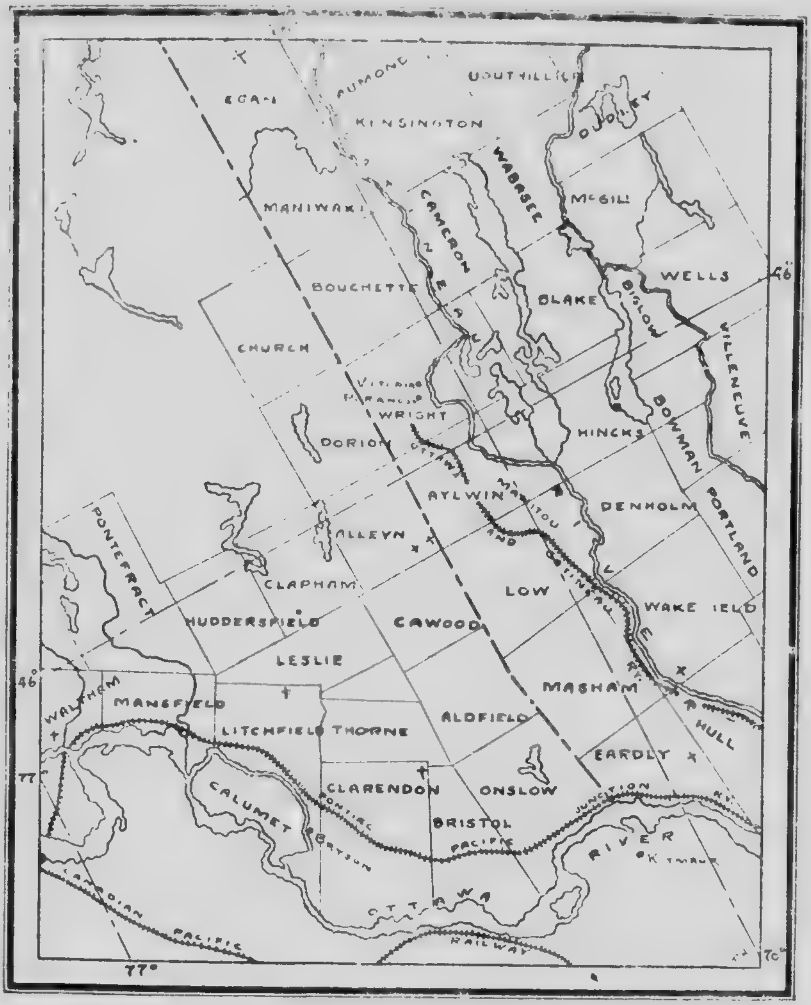

Fig. 6 - Map of the region north of the Ottawa river showing the position of the chief molybdenite occurrences.

museum purposes. In a recent communication from the manager of this Company. I learn their work was carried on for two months in 1894. eight men were employed, at a total expenditure of about $800. with a return of about 100 pounds of pure molybdenite contained in the specimens. The weight of the molybdenite specimens with the rock attached would possibly be nearly one ton.

The present owner of the mineral rights is, I believe, Norbert Genereux, Duclos, Pontiac co., Que.

Calumet Island, North Range.—The writer visited two of the prospects on Calumet island where pits had been dug for molybdenite. The country rock is sometimes crystalline limestone, and in other instances garnetiferous gneiss. At the time of this examination, the evidence seemed to indicate that, the supposed molybdenite was only graphite, and a careful chemical examination in the laboratory proved conclusively that molybdenite was quite absent from the specimens which were brought to Toronto. This location has been referred to so often in connexion with molybdenum, that one hesitates to affirm that this mineral does not occur there. Mr. A. O. Letts, of Campbells Bay, is interested in these properties, and his father drove me from Campbells Bay, and indicated the more promising outcrops.

Besides the four deposits mentioned above, there are many other known occurrences of molybdenite in the valley of the Gatineau. Mr. C. W. Willimott, late of the staff of the Geological Survey, Canada, states that from the township of Alleyn 'to a point 30 miles north of Maniwaki, it would be safe to say that molybdenite is found at frequent intervals over a wide range of country. I have seen specimens said to come from the townships of Alwin, Wright and Bouchette.[1]

The accompanying sketch map shows the location of some of the better known molybdenite occurrences in this region.

NORTHERN PONTIAC.

During the last few years, numerous and very promising deposits of molybdenite in association with bismuthinite have been discovered in the vicinity of Lake Kewagama in northern Pontiac. Up to the present the approach to this region is by canoe in summer and bush road during the winter. The base from which this whole region is usually reached is either North Timiskaming or Ville Marie, both on the eastern shore of Lake Timiskaming. From either of these places one has a land journey of 15 or 20 miles by wagon road to Lac des Quinze, whence the canoe journey to Lake Kewagama is usually accomplished in from three to five days.

The Transcontinental railway, now under construction, passes within 15 miles to the north of the outlet of Lake Kewagama; and as most of this distance can be traversed by canoe there is a prospect that in the near future this region will be easily reached by rail, with a short canoe or wagon journey of 15 miles from the railway to the lake.

The Height of Land Mining Company.

The first deposits to be developed were taken up by the Height of Land Mining Company, and are situated in the Township of Villemontel on the west

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[1] Bulletin on Molybdenum and Tungsten, p. 16, Geol. Survey of Canada, 1904.

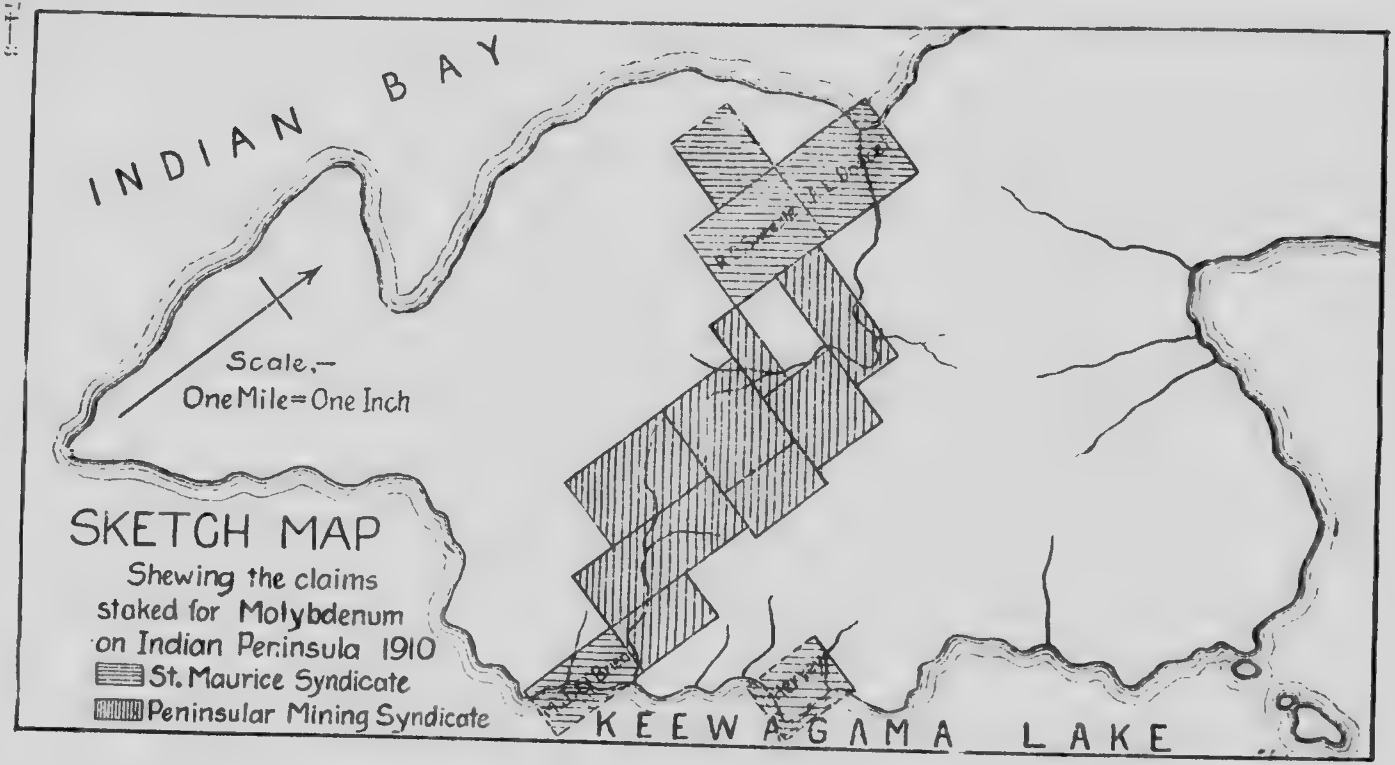
INDIAN BAY
KEEWAGAMA LAKE
Scale.—
One Mile = One Inch
SKETCH MAP
Shewing the claims
staked for Molybdenum
on Indian Peninsula 1910
▤ St. Maurice Syndicate
▥ Peninsular Mining Syndicate

Fig. 7.

side of the Kewagama river about two miles north of the outlet of the lake of the same name.

On the west bank of the river the rocks of the region are represented by mica schist which strikes north-northeast, and dips towards the west at a high angle. Following this general strike there is a mass of pegmatite carrying molybdenite and bismuthinite. Quite close to the bank of the river a shaft was sunk to the depth of 70 feet, and from the bottom an east and west drift extends from 20 feet west of the shaft to a distance of 50 feet to the east of the shaft, reaching some distance under the bed of the stream. These developments are said to have shown that the pegmatite which was exposed at the surface where the shaft was sunk is not a simple dyke, but rather a blanket or saddle striking north-northeast, and dipping both to the east and to the west. At the time the property was visited in September, 1910, the surface near the shaft had been deeply covered with the waste rock from the excavations, and the mine was full of water. It was, therefore, impossible to personally confirm the reports as to the nature of the pegmatite mass, or of the extent and nature of the underground workings.

In 1907, Mr. John A. Dresser examined this property before excavations had been undertaken. As a result of his examination, he states that the pegmatite mass to the west of this river was from 30 to 50 feet wide, and could be traced for 400 yards along the river bank. To the west the rock was biotite schist, while across the river granite was the chief type.

From an examination of the dump it is certain that the pegmatite mass is of large dimensions. The rock is composed largely of muscovite and quartz and is somewhat foliated as a result of shearing. The molybdenite is usually present in the form of six sided crystals, which vary from ½″ to 1½″ diameter. Bismuthinite was also observed, but owing to its ready decomposition when exposed to the weather, very little of this mineral in the natural state was to be seen. A sample from the Height of Land Mining Company's working—such material as might readily be selected for concentration—was assayed in the laboratory of the Mines Branch, Department of Mines, with the following result:—

Molybdenum	2·39 per cent.
Bismuth	nil.
Tungsten	nil.
Copper	3·10 per cent.

The complete absence of bismuth in the sample selected for assay shows that it should be possible to secure from this ore a concentrate quite free from this metal, which is, generally, undesirable in molybdenite concentrate. The pegmatite carries numerous other minerals such as feldspar, fluorite, beryl, pyroxene, and a little pyrite.

The ready cleavage of the sheared pegmatite and the relative thickness of the stout crystals of molybdenite suggest that the ore should be rather readily

Shaft House, Height of Land Mining Company.

concentrated by rolling and screening to obtain the coarsest of the molybdenite, followed by further crushing and treatment of the part which passed through the screen. The presence of so much bismuth in the ore offers a new problem, since up to the present there is no market for molybdenum ores carrying more than a trace of this metal. Some method of separating these two valuable constituents will be necessary before the ore can find a ready market. The accompanying photograph indicates the surface structures connected with the mine.

Molybdenite Deposits on Indian Peninsula.

Indian peninsula is the name given to a spur of land 10 miles in length projecting into Kewagama lake from the north. Nearly the whole of this peninsula lies within the boundaries of the township of Preissac. Throughout this large area the rock surface is well exposed, particularly in the interior. The common rock type is granite, containing muscovite, sometimes slightly banded as a result of pressure. In the country rock quartz veins, at times containing pinkish felspar, are very frequent wherever the rock is well exposed, as it is over a large part of the interior and on several points along the east coast of the peninsula.

For years it has been known that some of these quartz veins carried molybdenite, and this is indicated in the report and on the maps issued by the Superintendent of Mines for Quebec, in 1908. Towards the end of 1909 numerous claims were staked on the peninsula for molybdenite which is usually associated with bismuthinite. Most of these claims are now held by two syndicates: The Peninsular Mining Syndicate, of Montreal, and St. Maurice Syndicate, of Quebec. The areas occupied by these two syndicates are indicated on the accompanying map. The topography, in so far as the outline of the peninsula is concerned is very faulty.

Th [illegible] on was visited in September, 1910, and the prospect pits—opened during the previous summer by the prospectors—were examined. Unfortunately, none of those who had been prospecting for the Peninsular Mining Syndicate were to be found in the district, so that it was not possible to search out the most promising places on their claims. I was fortunate in having the guidance of some of the representatives of the St. Maurice Syndicate so that it was possible to find out and examine a very large number of places where blasting had been done on the quartz veins. In all about fifty or sixty such openings were found. Generally, the work consisted in blasting off the top of the quartz mass by one or more shots of explosive.

The O'Brien Claim.

This claim is located on the southeast shore of the peninsula, and some of the workings are quite near the water's edge. Here, several veins are exposed, and a cross-cut had been made to show up the character of the deposit. The country rock is a pegmatite granite, while the vein filling is quartz, carrying molybdenite in stout crystals and a minor proportion of bismuthinite. Pyrite, chalcopyrite, fluorite, and white mica are the other constituents of the vein mass. In 25 feet of the open-cut, four veins are intersected. They strike towards the northwest and dip about 45° towards the northeast.

Seven hundred pounds of ore were taken from the openings on the shore and shipped for samples, on which experiments in concentration were made in Kingston, and Denver, Colorado. While no samples for assay were taken, it is certain that molybdenite bearing border of pegmatite would not carry more than one-half of one per cent molybdenite.

Inland, near the northern boundary of the claim and possibly a furlong from the shore, three large veins are exposed measuring 10 feet, 4'-6", and 3 feet across. These veins strike nearly east and west, and dip about 80° to the north. Along with very glassy quartz, which is the chief vein mineral, bunches of white mica are prominent. Here, the molybdenite is usually confined to the outer zones of the vein, while towards the centre bismuthinite is more abundant than the molybdenite. In the most northern of these three veins bismuthinite far exceeds the molybdenite in quantity. In the other two the bismuthinite is less abundant than the molybdenite. Pyrite and fluorite occur in minor proportions. These quartz veins are said to be practically free from gold.

The Hervey Claim.

This claim is situated on the east shore a short distance north of the O'Brien. A few small pits near the shore represent the development work. These pits were not examined personally, but it was learned that these deposits are similar to those observed on the O'Brien.

The Doucet and Sweezie Claims.

On the west side of the peninsula the St. Maurice Syndicate holds three claims, on two of which (the Doucet and Sweezie claims) considerable development work has been done. The work generally consists in small pits—the result of one or two shots—to the number of about fifty. The rock surface on these claims is well exposed, being practically barren, and usually free from tree growth. The rock is a grey muscovite granite, slightly banded, and medium in grain. A great number of quartz veins varying from 1 to 10 feet across were observed. The general direction is northwesterly, and the dip is towards the northeast at high angles. The quartz is glassy and carries a very little feldspar, pyrite, and fluorite along with the ores—scaly molybdenite and bismuthinite. In many of the veins the quartz is frozen to the walls. The molybdenite is sometimes subordinate in quantity to the bismuthinite, which often takes the form of great bladed crystals reaching in some cases to a length of 9", with a width of ¾". Generally, these crystals are thin, and might not represent so rich a bismuth content as one would judge from a first impression.

No effort appears to have been made to establish the continuity of the quartz veins across the peninsula, though it is locally believed that individual

PLATE VII.

Molybdenite bearing Quartz [illegible], [illegible] and Sweeney [illegible]

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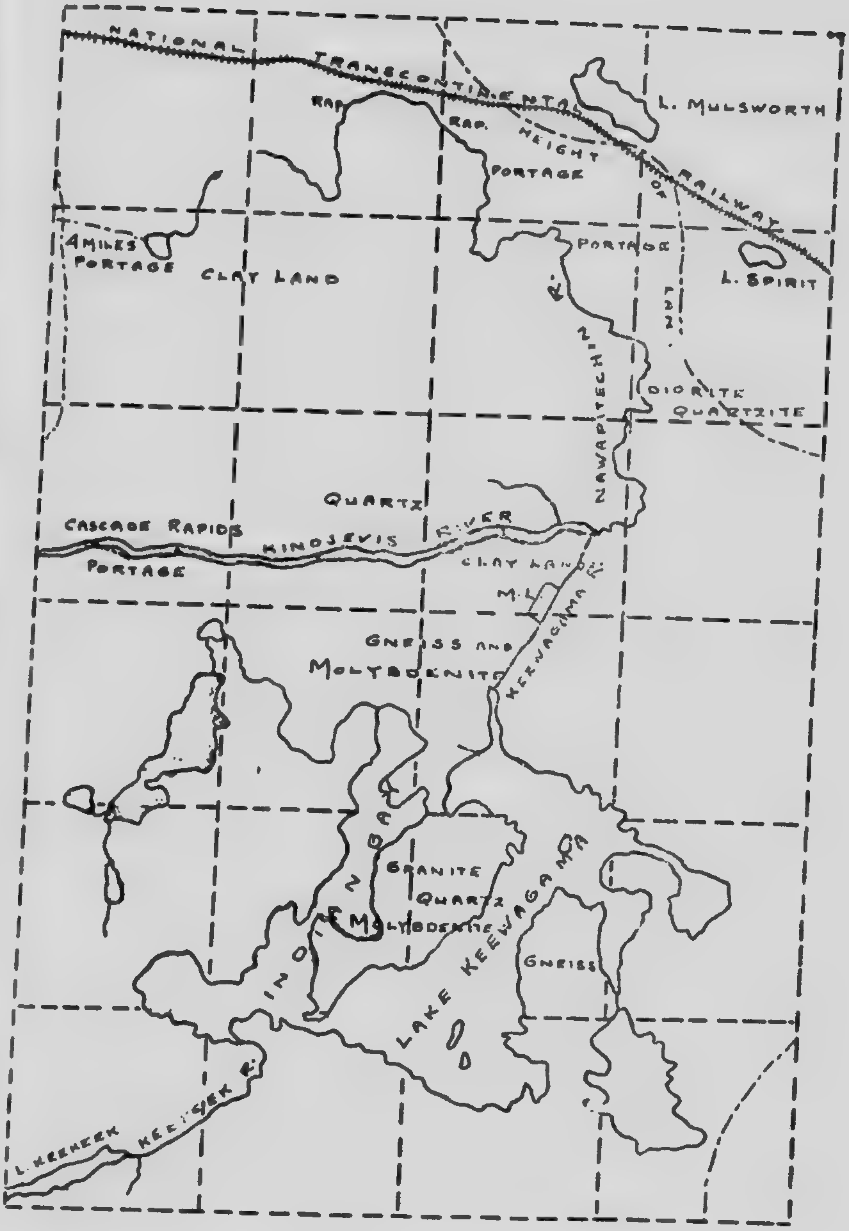

FIG. 8. -Map of the Lake Kewagama molybdenite region, North Pontiac. After Obalski.

veins are really continuous across the whole peninsula. Personally, this seems improbable, as even over the limited area where they are exposed, some of the veins fork, pinch out, or depart seriously from the direction of the general strike.

Near the blacksmith shop one splendid deposit has been the subject of somewhat more serious development. On the northeast side of a glaciated hillock, a mass of quartz—apparently a vein—stretches in a northwesterly direction for some distance, and has been uncovered and tested by numerous shots for over 50 feet in length. Here the molybdenite is quite scaly, but not so coarse leaved as on the O'Brien claim. No cross-cut has been made, so that the thickness of the veins is not known. A sample such as might be picked out for concentration was assayed in the laboratory of the Mines Branch with the following result:—

Molybdenum	2·60 per cent.
Tungsten	nil
Bismuth	nil
Copper	nil

The general absence in the sample assayed of both bismuth and copper is a matter of congratulation. So large a mass of molybdenite bearing ore, carrying 4⅓ per cent of molybdenite, and at the same time free from the two metals which are very undesirable in ores of molybdenum, should be well worth further development. This exposure represents the best to be seen in September, 1910, on the property of the St. Maurice Syndicate on the west side of the peninsula.

The Claims of the Peninsular Mining Syndicate.

These claims are all in the central part of the peninsula. At the time the region was visited, some prospecting had been done, and it is said that numerous small prospect pits had been made. None of those who had worked on these claims was in the district, and consequently only a few of the pits were examined. In a general way they resemble most of the pits on the Doucet and Sweezie claims, but no deposit was found equal to that located near the blacksmith shop. Presumably, had the whole of their pits been examined, better deposits might have been observed.

ONTARIO.

CENTRAL ONTARIO.

Victoria County.

Laxton and Somerville.—In the 'Geology of Canada,' Sir William Logan states that molybdenite, associated with pyroxene, has several times been met with on Mud lake, in the vicinity of Balsam lake; and in one case accompanied with copper pyrites in quartz.[1] It is probable that Logan refers to the deposits of molybdenite in the townships of Laxton and Somerville, Victoria county. They are on the shore of Mud Turtle lake, which is not far from Balsam lake. Unfortunately, there are in Canada many Balsam and Mud lakes, so that one cannot be certain that he refers to the localities in question. Mud Turtle lake is sometimes called Mud lake. The occurrence of molybdenite in the vicinity of Mud Turtle lake has been known for fifty years.

Mud Turtle lake is surrounded by rocks of the Grenville series—crystalline limestone with gneisses of various kinds. The rocks strike toward the northeast and dip toward the southeast at low angles. A deposit of molybdenite occurs on the west side of the lake on the farm of William Adair, Norland, P.O., lot 5, concession xi, of Laxton. The mineral rights are held by John Webber and associates of Toronto, who sank some test pits seven or eight years ago, and shipped from Coboconk over three tons of ore, valued at $400.[2]

The largest pit was dug on the margin of the lake, and is about 30 feet diameter, and its greatest depth is about 7 feet. From an examination of the rock dump it appears that the molybdenite is frequent in the pyroxene rocks as well as in the crystalline limestone. The ore as seen in the walls of the pit is associated with pyrite, and is concentrated along the contact of the limestone and pyroxene rock.

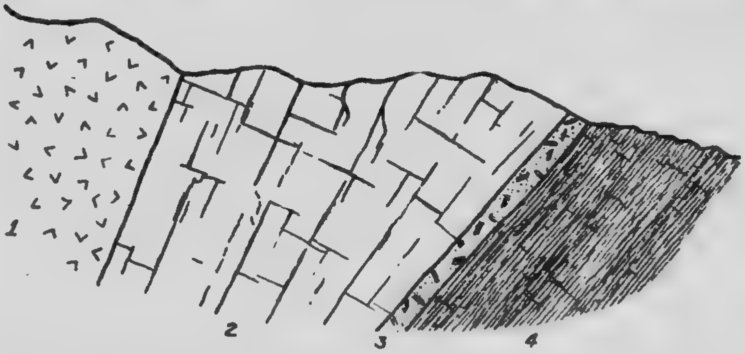

FIG. 9.—Section in pit on lot 3, concession A, Somerville township, Victoria co., Ont.

1. Granite.
2. Crystalline limestone.
3. Molybdenum bearing band.
4. Mica schist.

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[1] Geology of Canada, 1863, p. 502.

[2] **Report, Bureau of Mines, Vol. XII, p. 25, 1903.**

Across the lake to the northeast, on lot 3, concession A, of the township of Somerville, in line with the strike of the rocks of the region from the deposit just referred to, several pits have been dug for molybdenite. The surface and mineral rights belong to Wm. Adair, Norland P.O.

The molybdenite is associated with pyrite, and follows the contact between the crystalline limestone and a thin bedded, very quartzose, mica schist. The molybdenite scales seldom exceed ½″ diameter, and are associated with pyrite in a band not more than 2″ wide. In the region around, very massive granite is a prominent rock. It appears in one side of the molybdenite pits. The accompanying sketch illustrates the section seen looking towards the southeast.

Apparently the limestone had exerted a special precipitating influence on the vapours or solutions which introduced the ore. The frequent association of crystalline limestone, green pyroxene rock, and intrusive granite with molybdenite ore bodies has been already referred to.

According to information from Mr. Adair, molybdenite has been observed in numerous outcrops in this vicinity, extending 15 miles towards the northeast throughout the limestone belt. In the vicinity of Gull lake loose crystals and flakes have been found in the soil, but no promising deposits are known.

Haliburton County.

Lutterworth Township, Lot 7, Concession X.—In a gneissoid rock containing hornblende and scapolite occur two parallel quartz veins about 2 feet apart, carrying a little molybdenite. The rock strikes north-northeast and the veins east-northeast. The dip is nearly vertical. These veins sometimes attain a thickness of 8″. At the time the property was visited, it did not appear to promise well; as the smallness of the veins and the sparse distribution of the ore combine to render the cost of production very high. With further development a more favourable prospect might result. A sample from this claim assayed in the laboratory of the Mines Branch gave the following result:—

Molybdenum..	0·35 per cent
Copper..	nil.

In Davis lake, on a small island, a flat lying molybdenite bearing quartz vein occurs in rock of the same type. Both these outcrops occur on property of Mr. A. Y. Hopkins, of Kinmount.

Mr. Hopkins reports the presence of loose masses of molybdenite in decomposed limestone and in the loose surface soil and gravel about two miles from Gull lake, possibly on lot 12 or 13 in the first concession of this township.

Harcourt Township, Lots 2 and 3, Concessions I and II.—About 3 miles north of Wilberforce station, near the southwestern end of Farquart lake, explorations were conducted in the autumn of 1902 by the Haliburton Company, under the direction of Mr. S. Dillon-Mills, of Toronto. The rocks of the region are

PLATE VIII.

Open-cut on the Molybdenite deposit,
Harcourt township.

274 p. 40.

very complicated, but on the whole represent the oldest types, commonly known as Laurentian. The chief rock is gneissoid granite with inclusions of massive greenish black pyroxene rock, and occasional masses of crystalline limestone. In this complex, in association particularly with the pyroxenite, there are found rusty surface products betraying irregular stringers of pyrite, pyrrhotite, chalcopyrite, and molybdenite.

Since 1902, no work has been done on this prospect, and at the time visited by the writer, most of the surfaces were marked by decomposition and by vegetable growth, so that very little could be observed regarding the relationship of the various ore and rock types to one another.

The following extracts from a report by Mr. S. Dillon-Mills[1] contain the most important features as to the nature of the deposits and the results of the development work.

'The first few shots opened out a large vug on the south side and a seam of iron pyrites (the ordinary non-magnetic FeS_2) with a little molybdenite leading into a pyrites pocket containing over a ton of pyrite free from molybdenite. We then crossed another open vug running across the cut, then struck another seam of pyrites, next came about 5 feet of somewhat more solid rock, and then a vein of pyrrhotite with some molybdenite. We exposed in this way five narrow veins of pyrrhotite carrying more or less molybdenite and traces of chalcopyrite. Of these veins two were connected by a cross vein, about 7 inches in width; the contents of which showed nearly half molybdenite, the balance being pyrrhotite and chalcopyrite. The molybdenite was in fair sized crystals, 1 to 2 inches diameter. This was near the north wall of the cut, and towards the south wall another thinner vein of similar character was found running diagonally between the same two main veins or stringers, showing good indications of our approach to a body beneath. The upper shallow strippings showed also some seven or eight other stringers, from 1 to 4 or 5 inches in width, carrying molybdenite in places.

'The occurrence of two distinct sets of stringers each forming with its cross veins a sort of independent 'stockwerk,' one containing magnetic pyrites with chalcopyrite, the other, ordinary pyrites and marcasite: the two occurring in pyroxenite but separated from each other by a 5 or 6 foot rib of very hard rock differing somewhat from the pyroxenite, lighter in colour, variable apparently in composition but very hard to drill.

'Pyroxenite is considered to be an alteration product from an impure limestone, and in the mass to the southwest of this, where there appears to be neither molybdenite nor pyrrhotite, it is in contact with mica schists, and mica passing into crystalline limestone containing graphite in small quantities but no molybdenite.'

The accompanying photograph shows the nature of the excavations on this property.

Cardiff Township, Lot 11, Concession IX.—Near the contact of pegmatitic granite and biotite gneiss there is a pyritic band carrying in some parts copper, in others molybdenite, and in other places little but pyrite. Three pits have been dug. The centre one is quite near the contact, and in it a very promising body of molybdenite-bearing ore is disclosed. The geological arrangement of the chief rock type is well illustrated on the map by Adams and Barlow,[1] from which it appears that the deposit is located near the contact of granite and the gneiss complex in which bands of crystalline limestone are prominent constituents. Numerous examples have been recorded of deposits of molybdenite near granite marble contacts.

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[1] Report Bureau of Mines, Toronto, 1902, p. 45.

The pyritic band strikes N 20° E. The pit showing molybdenite is about 35 feet deep, and about 8 feet square. It was dug in 1907. The north wall of the shaft shows the distribution, as indicated in the sketch below.

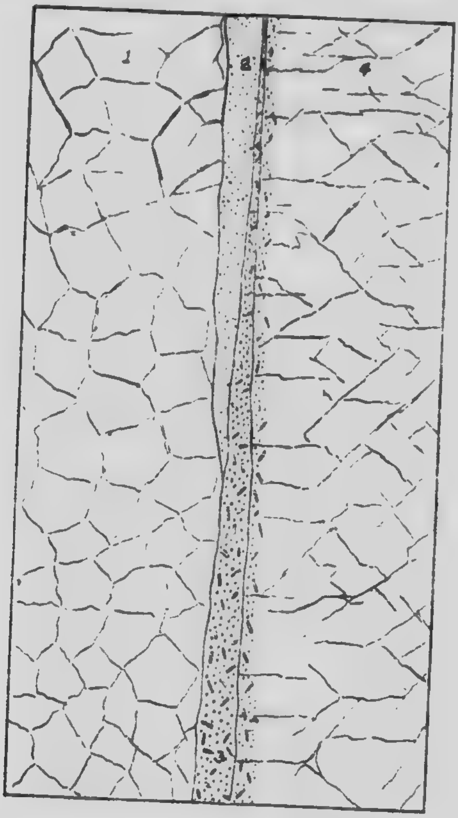

FIG. 10.—Section of shaft showing molybdenite, lot 11, concession IX, Cardiff township.

1. Mica scapolite rock.
2. Pyrrhotite.
3. Pyrite carrying molybdenite.
4. Pyroxene rock with pyrite.

At the surface, the molybdenite band was only 1″ wide, but it is reported to have widened to 20″ at the bottom of the shaft. The ore is

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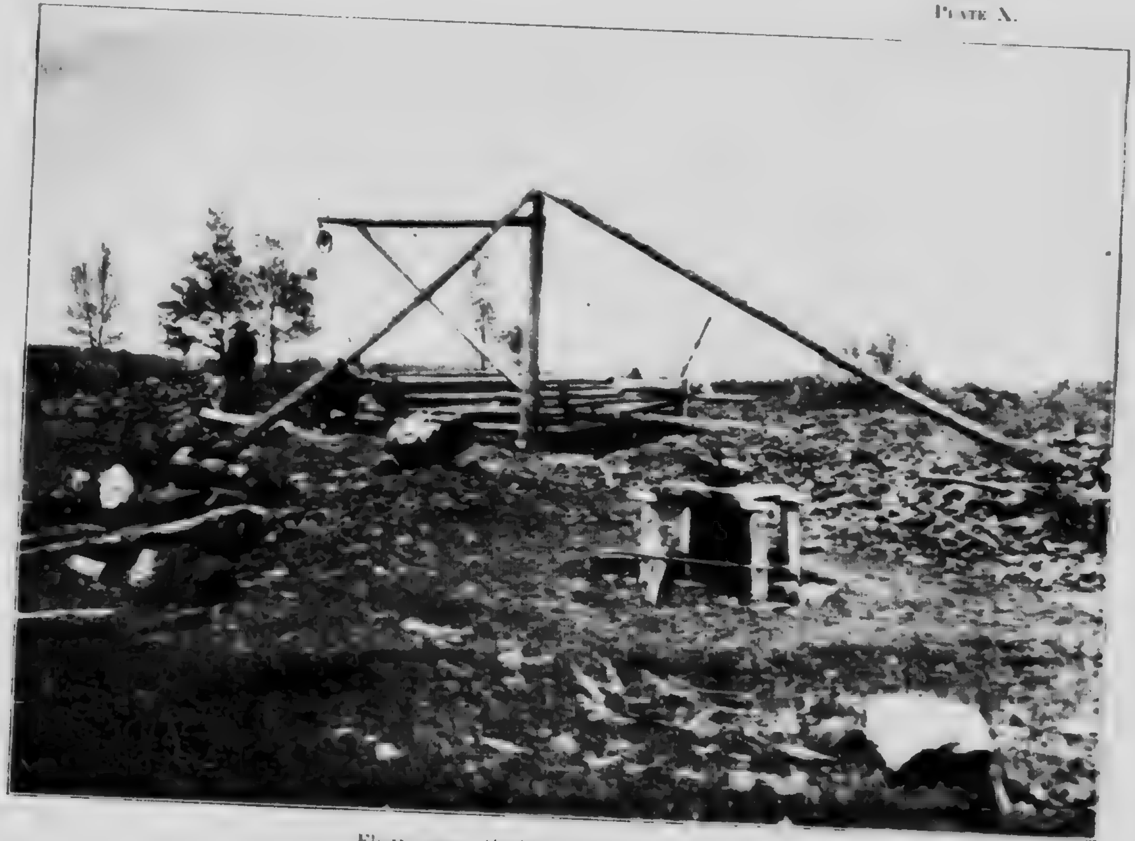
[1] Adams and Barlow, Haliburton Sheet, No. 708, Geological Survey, 1905.

Plate IX.

Open-cut on the Dwyer deposit.

274 p. 42.

PLATE A.



Elliott's mine, Cardiff township: general view.

PLATE XI.

Elliott's mine, Cardiff township: ore pile.

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specially associated with the pyrite, but extends to a minor degree into the wall rock, at times as far as a foot from the pyritic zone proper. The molybdenite crystals are often completely enclosed in the wall rock, especially in the pyroxenic rock type. In general, the plates are thick, and attain a maximum diameter of 2" to 3".

This deposit is about 10 miles from Wilberforce station, on the Irondale, Bancroft, and Ottawa railway, and near Cheddar post-office. It is on the farm of a Mr. Evans, who shares the mineral rights with four others, including Messrs. Elliott and Dwyer, of Wilberforce.

Assayed in the laboratory of the Mines Branch, a sample of this ore yielded the following result:. .

Molybdenum.	2·35 per cent.
Copper.	nil.

The accompanying photographs give a general view of the prospect, and also a picture of a pile of ore in which the large molybdenite crystals are indicated as white spots on the dark rock mass. On the whole this is one of the most encouraging molybdenite deposits examined in this region.

Hastings County.

Monteagle Township, Lots 26 and 27, Concession VI.—In the museum of the Geological Survey[1] there are specimens of molybdenite from lot 26, concession VI, of the township of Monteagle. To gain additional information as to the mode of occurrence, the property from which the specimen was obtained was visited. The country rock is biotite gneiss, probably belonging to the Grenville series. It was learned that a Mr. Best had sunk several pits on Mr. Spencer's farm, apparently for phlogopite or amber mica. A careful examination of the dumps and of the walls of the pits above water, showed that the rock excavated was largely greenish pyroxene, with considerable amber mica. Scapolite, titanite, pink calcite, diopside, and fluorspar, were present in small proportions. No molybdenite was observed. Such mineral associations are common in mica mines, and in them molybdenite is not infrequent. While not certain, the writer is of the opinion that it was from these pits the specimens in the museum of the Geological Survey were obtained.

Addington County.

Sheffield Township, East Half Lot 5, Concession XIV.—On the farm of Timothy Dwyer, some 10 miles eastward from Tamworth, a deposit of molybdenite was discovered, some years ago, just south of the old California road. It was operated in 1904 by Mr. A. M. Chisholm, of Kingston, who dug a pit about 50 feet diameter, which has a greatest depth of about 10 feet. It is said that eighty-five tons of picked molybdenite ore were shipped to the United

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[1] Report, Geological Survey, 1894, p. 98 A.

States, and sold for $1,275. A sample of such ore as would be regarded as fit material for concentration was assayed in the laboratories of the Mines Branch with the following result:—

Molybdenum	1·76 per cent.
Copper	nil.
Sulphur	27·5 per cent.

According to a communication from the proprietor, Mr. A. W. Chisholm, the ore carries values in gold and nickel.

Geologically, the region is composed largely of gneiss, containing bands of limestone, which extend in a northeasterly direction. In the gneiss complex there are intrusions of granite. It is near such a granite limestone contact that the deposit is situated.

The excavation is almost entirely in impure limestone and greenish pyroxene rock. Pyrite and pyrrhotite are the prominent sulphides, and along with them the molybdenite occurs in crystals of considerable size and thickness. So far as could be observed the sulphides were largely confined to a more or less horizontal band some 6 feet thick, but according to information from Mr. Dwyer good ore was also obtained from the deepest portions of the pit, which was partly filled with water at the time the deposit was examined. This is one of the most promising deposits of molybdenite visited. The accompanying photograph gives some idea of the nature of the excavation.

EASTERN ONTARIO.

Carleton County.

March Township, Lot 6, Concession II.—On a pegmatite dyke in crystalline limestone a small pit was dug some years ago by Mr. C. W. Willimott, of the Geological Survey staff. Some molybdenite was extracted to be used as mineralogical specimens. At the time the pit was examined, June, 1910, there was little molybdenite to be found, and the deposit did not appear to be of an economic character.

Frontenac County.

Miller Township, Lot 5, Northeast Range.—On the property of John R. Kring, molybdenite occurs in pegmatite, which follows the northeasterly strike of the gneisses of the region. The pegmatite forms a dyke which has a maximum width of 8 feet. Pink feldspar is the chief mineral—sulphides, generally, are absent, with the exception of molybdenite. Four pits have been opened on the pegmatite dyke, and while molybdenite has been found in all of the pits the quantity is not very encouraging. Molybdenite is found as an alteration product. The excavations were made about ten years ago, and specimens from this deposit were exhibited by the Ontario Government at the Pan-American exhibition, shortly afterwards.

Three-fourths of a mile to the northeast, Messrs. Elkington and Tooley have done some prospecting on a similar quartz pegmatite dyke whose width seldom exceeds one foot. Here, black tourmaline accompanies the molybdenite in the pegmatite mass.

Leeds County.

North Crosby Township, Lot 14, Concession V.—Some twenty years ago on the farm of Mr. Samuel Merkley, two pits were dug on the east side of the road. It was believed at the time that the rocks contained lead; but it was later learned that the lead grey mineral was molybdenite. Since then, no work has been done. The association of rocks is a common one—an igneous intrusive granite or syenite, crystalline limestone with considerable dark greenish rock largely made up of pyroxene and scapolite. The pits have been partly filled up, but sufficient of the walls and of the excavated material may yet be observed. This occurrence does not appear to be of economic importance.

Renfrew County.

Lynedoch Township, Lots 5 and 6, Concession VIII.—One of the best surface showings of molybdenite in Canada occurs on this property which is owned by the Jamieson Meat Company, of Renfrew. In the autumn of 1907, the late R. A. Jamieson prospected on this property with a gang of men, dug several pits, and cobbed the ore taken out. The cobbed ore consisted almost entirely of thick heavy plates of molybdenite, practically free from any trace of rock. No exact statement exists as to the weight of the pure ore obtained, but the writer is convinced that at least one ton must have been obtained in this way. No machinery was employed, the whole of the work being done in the wilderness, and only the simplest appliances were available.

This property may be reached by a drive over a bad road for about 40 miles from Renfrew. Geologically, the country is composed of gneisses of various kinds, interspersed with bands of crystalline limestone. The general strike is east-northeast. This gneiss series is frequently cut by intrusive granites and pegmatites, and the deposit of molybdenite occurs near such an igneous contact with the limestone. The molybdenite is intimately associated with pyrrhotite and pyrite. These three minerals rarely occur in the gneissoid granite or in the limestone, but are generally distributed through the pegmatite dyke which is about 4 feet wide, and frequently in the green pyroxene rock. The crystal plates of molybdenite are unusually large, as seen in the cobbed ore. Only a small fraction of the whole occurs in pieces less than 1″ diameter, and $\frac{1}{16}$″ in thickness. One mass picked out from the cobbed ore weighed almost six pounds, and was nearly pure molybdenite. Molybdite is frequent near the surface. The pyrrhotite appears to weather very easily, so that the whole rock disintegrates, and the molybdenite crystals are set free.

The development consists of a trench which follows the pegmatite mass for about 200 feet, and at the end of which is an irregular pit about 18 feet diameter, with a greatest depth of 25 feet. The lower part of the pit could not be examined owing to the large amount of water which it contained.

A sample of such ore as might reasonably be selected for concentration was assayed in the laboratory of the Mines Branch with the following result:—

Molybdenum.	7·42 per cent.
Copper.	nil.

The accompanying photographs show the nature of the excavations and the degree of development reached in June, 1910.

Raglan Township, Lot 6, Concession XVIII.—In the northwestern part of the township of Raglan the gneissic granites have been intersected by intrusive alkali dykes which frequently carry corundum. The corundum-bearing rocks show numerous seams in which minerals, apparently later, have been deposited. These bands of younger minerals are made up of the following in order of their abundance: pyrite, pyrrhotite, calcite, quartz, felspar, scapolite, reddish muscovite, diopside, and molybdenite. The last mentioned mineral forms thin foliated sheets which rarely attain 5″ across and ½″ in thickness. Usually, the plates are not more than ⅛″ thick, and less than 2″ diameter. Although the corundum quarries have been extensively operated for about ten years, during which time molybdite has been frequently observed, yet it has never been abundant enough to be regarded as an economic mineral, and the total amount if saved would have represented not more than a few hundred weight. Fine specimens of molybdenite are frequent, but not in economic proportions.

Ross Township, Lot 22, Concession II.—Near Haley Station on the Canadian Pacific railway, on the farm of John Rose, there is a deposit of molybdenite in an irregular band of very quartzose pegmatite in biotite gneiss. The rock formations strike nearly north and south, and dip about 30° towards the east. The pegmatitic band carrying the ore stretches towards the northeast, intersecting the gneiss at an angle. The pegmatite carries small quantities of pyrite. The molybdenite forms thin flakes usually in the quartz. Near the surface yellow molybdite is mingled with the molybdenite.

This deposit has been worked, and at present the pit dug on the pegmatitic band is about 30 feet long, 8 feet wide and at its deepest 8 feet. It has been operated on three occasions by various persons. Some years ago the Geological Survey obtained from this deposit 250 pounds of ore for the experiments in concentration carried on by Professor J. B. Porter of McGill University. The ore was not cobbed, but was subjected to concentration in the form in which it was removed from the mine. On assay, it yielded 1 per cent molybdenite. The concentrate obtained assayed 33·5 per cent molybdenite, and in it was saved 52 per cent of the total value. The remainder was lost in tailings, or in lower grades of concentrate. The great hardness of the quartz gangue, and the thinness of the molybdenite scales, would lead one to anticipate a high loss of molybdenite in any attempt to concentrate this ore except by some method in

Plate XII.

Chief pit on the Jamieson claim, Lyndoch township

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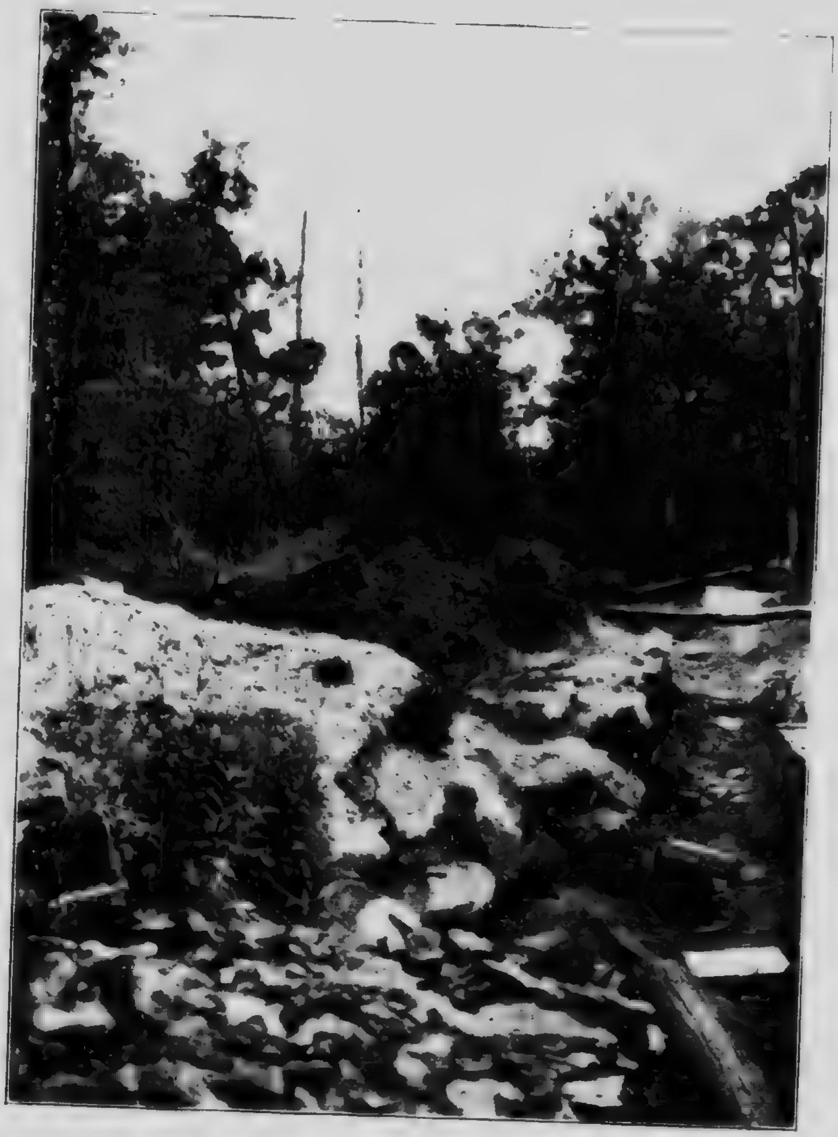

Pegmatite dyke, Jamieson claim, Lynedoch township.

which there is no special loss due to extremely fine pulverization of the ore. A sample of such ore as might be selected for concentration was collected by the writer, and assayed in the laboratories of the Mines Branch, with the following result:—

Molybdenum..	1·61 per cent.
Copper..	nil.

Ross Township, West Half Lot 7, Concession IX.—Near Forresters Falls, on the farm of Mr. John J. Elliott, some excavations were made about twenty years ago in crystalline limestone which forms a north and south band. After so many years the walls have become rusty, and little can be observed except that a little molybdenite is present along with pyrite in the limestone. Apparently not economic.

Brougham Township, Lot 8, Concession XI.—On the farm of Daniel Hunt, a deposit of molybdenite occurs in flat lying gneiss containing bands of crystalline limestone. This gneiss complex has been invaded by masses of pegmatite and near the contact of the igneous rock and the gneiss limestone series a deposit of molybdenite is located. As usual, under such circumstances, there is a great development of greenish pyroxenite which carries pyrite and pyrrhotite along with the molybdenite. The deposit is said to have been worked by some New York capitalists who have made some payments to the proprietors, and have shipped one car load of ore.

The deposit is situated on Mount St. Patrick, on the west side of a ridge, where, within a distance of 400 feet, five pits have been dug on about the same horizon.

The accompanying photograph indicates the horizontal nature of the various rock types: uppermost, pegmatite; next below, greenish pyroxenite, carrying the molybdenite, pyrite, and pyrrhotite; and below this, the white granular marble.

Some of the pits are quite large, and on the whole this must be regarded as one of the most important molybdenite deposits of the Ottawa valley. A sample from the largest pit assayed in the laboratories of the Mines Branch, Ottawa, gave the following result:—

Molybdenum..	3·14 per cent.
Copper..	nil.

Brougham Township, Lot 8, Concession XII.—This property adjoins the one just described. Comparatively little development has been undertaken. In general there is a close resemblance, but up to the present nothing very encouraging has been opened up. The mineral rights are said to belong to Mrs. D. Guiney.

A sample from this property was analysed in the laboratories of the Mines Branch, yielding the following:—

Molybdenum..	0·98 per cent.
Copper..	nil.

NORTHERN ONTARIO.

Nipissing District.

Nett Lake, near Timagami.—Some 4 miles north of Timagami station, and one-fourth of a mile east of the railway, near the shores of Nett lake, a deposit of molybdenite was opened up three years ago. The country rock, which is a dark basic rock, altered and soft, has been shattered, and the fragments cemented by quartz forming a breccia. Molybdenite, and some chalcopyrite, are readily observed. The former mineral occurs in leafy rosettes which occasionally attain a diameter of 2". There is no well defined vein of quartz. Quite close by, a very rich mass of gold quartz had been discovered, and the explorations undertaken were prompted by a desire to locate the vein from which this mass came. The molybdenite ore carries a little gold as shown by the assays.

Three areas of the brecciated ore were observed, separated from one another at distances of about 200 feet, the areas occupying the position of the angles of a triangle. On the southern outcrop a shaft was sunk, and a considerable amount of ore and rock removed. On the claim there are some cabins erected at the time of exploration.

Assayed in the laboratories of the Mines Branch the following results were obtained:—

Molybdenum.	4·67 per cent.
Copper.	0·10 "
Gold.	0·02 oz. per ton.

Talon Chute.—Molybdenite has been frequently reported at the Talon chute, some 25 miles east of North Bay. This locality was visited, and a considerable mass of crystalline limestone examined. No molybdenite was to be seen, but graphite in the form of small scales was of frequent occurrence. It is probable that the reported discovery of molybdenite at this place is due to a confusion of these two minerals with one another. In 1909 a similar confusion was reported in connexion with the supposed discovery of molybdenite on Calumet island. Graphite was found, but no molybdenite. In both cases it is still possible that molybdenite may have been found, but the probability is strongly in favour of the other explanation.

Rainy River District.

The following paragraphs were prepared for this report by Mr. A. L. Parsons, of the University of Toronto, who spent the field season of 1910 in the region on behalf of the Ontario Bureau of Mines.

'The existence of molybdenite in the Lake of the Woods region has been noted by Lawson,[1] who mentions an occurrence of this mineral in veins traversing granitoid gneiss on Quarry island near the Sultana mine. A visit to Quarry island was made, but unfortunately the veins carrying molybdenite could

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[1] Report, Geological Survey of Canada, 1885, p. 144 CC.

Pit on the Hunt property. The horizontal arrangement of the rocks may be observed.

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not be found. It is also reported that molybdenite was found in the ore at the Sultana mine.

'On examining the Mikado mine the writer found small particles of molybdenite disseminated in many parts of the vein. These particles were too small and in insufficient quantity to be used as an ore of molybdenum, but it would be well to watch the ore carefully so that in case a large body of molybdenite were encountered, this material might be treated separately.

'On mining location D 149, in Bag bay of Shoal lake, about half a mile from the Mikado mine, is a vein in grey granite. On account of high water the development work that had been done did not show up well as the opening was under water. The vein, however, is about a foot wide and consists principally of quartz in which scales of molybdenite nearly half an inch in diameter are scattered rather abundantly. Much of the molybdenite is oxidized so as to give the yellow oxide of molybdenum, molybdite. The vein at this place is principally under water and in all probability not more than 20 feet could be exposed above water. The material, however, gives promise of value as a molybdenum property, though it is impossible to make a definite statement of the value on such small showing.

'Near the south end of Smoothrock lake in the Manitou region an occurrence of molybdenite which is of interest from a scientific point of view was found by the writer. The rock at this point is [illegible] as altered trap, in which determination the writer agrees. This [illegible] the lake between Laurentian gneiss and later granite. In this trap [illegible] location 148 S.V. which carries pyrite, pyrrhotite, gold, and molybdenite. About an eighth of a mile in a southerly direction from this vein a sample of the trap was broken and small scales of molybdenite found. The occurrence of molybdenite in trap is unusual as this mineral seems to occur almost uniformly in acidic rocks. Inasmuch as this exposure is near the contact of the trap and granite it is quite possible that the proximity of the granite has much to do with the occurrence of the molybdenite.

'While in Dryden the writer was shown samples of molybdenite which were stated to come from a granitic region south of Gull lake at a point about 17 miles northeast from Dryden. The samples were the most promising seen by the writer in this whole region.'

BRITISH COLUMBIA.

In the Province of British Columbia molybdenite has been reported from many mining regions, some of which are very difficult to reach owing to the distance involved and the unfrequent sailings of steamers to some of the deep bays and inlets along the northern coast region. In other instances the location and description of the means of approach are too indefinite to make it possible to visit the deposits without a great deal of prospecting and exploration. This lack of exact definition is well shown in Dr. G. M. Dawson's list of molybdenite localities in British Columbia.[1] In some cases Dr. Dawson had been able to verify the reports and then he gives considerable information; out in the majority of instances he merely records having heard of such deposits or having seen specimens from the localities in question. From a practical view point it is desirable to know the nature of the ore body; the probability of an economic production, and the location with sufficient exactness to make it possible for readers to visit and examine for themselves. Considering the mobility of the mining population of British Columbia, and the fact that some of the deposits were reported over twenty years ago, it seems very probable that many of the deposits have been virtually lost, and must be prospected for and discovered a second time before further information will be obtainable.

The writer was able to visit only a small number of the more easily reached deposits, but in the following pages such information as is available will be recorded, merely for the sake of completeness, and as an aid to the molybdenite prospectors of the future.

TEXADA ISLAND.

The northern part of this island is largely composed of sedimentary rocks which have been altered by the intrusion of igneous masses. Limestone has been converted into marble and where the rock was impure various silicates such as lime garnet and wollastonite have been developed. In the contact region ore bodies of copper—bornite and chalcopyrite—have been formed and with these copper deposits molybdenite has been deposited. In the vicinity of Van Anda, copper is mined in the Marble Bay, Cornell, Copper Queen, and Little Billy mines. The ore carries values largely in gold, and to a less extent in silver. All of the above-mentioned mines were in operation for copper in June, 1910.

In these mines the molybdenite is very fine grained, and almost devoid of the usual leafy structure. It may be noted that in the Giant mine, Rossland, and in Harvey Hill mine, in the Eastern Townships, where molybdenite is associated with copper ore the same characteristic fine grained massive structure has been observed. For purposes of concentration this may be a great disadvantage, while the presence of copper in molybdenite renders the ore less suited for steel manufacture, and hence diminishes its value.

In the Marble Bay mine the molybdenite is usually found in the same shoots as the good copper ore where the gangue rock is mostly marble. While at times it forms masses as large as one's fist, it is more frequent in thin layers along joints and slipping planes. It has been found at various levels, and at the time the mine was visited it was observed in the ninth level and was reported at the 1,060 ft. level. These occurrences are nearly 1,000 feet below sea-level, and it is remarkable that at this depth the copper is mostly in the form of bornite. The Chinamen who cob and sort the ore pick out the molybdenite, which is sacked separately.

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[1] Dr. G. M. Dawson, Report, Geological Survey of Canada, p. 157 R, 1888.

A sample, such as was being sacked, assayed in the laboratory of the Mines Branch, yielded the following result:—

Molybdenite	8·88 per cent.
Copper	1·85 "
Gold	0·08 oz. per ton.
Silver	trace.

In the other three mines the molybdenite is more frequently found in the lime silicates (locally known as felsites), and particularly in the bands of brownish garnet, probably andradite. This rock does not carry much copper, and the ore might be obtained from these mines comparatively free from copper, but the garnet rock is so very much harder than the marble that the concentration would probably be more difficult owing to the easy pulverization and consequent sliming of the molybdenite. The ore occurs at various depths. In the Cornell it is said to be relatively abundant at the 300 ft. level. In the Little Billy, according to Mr. Thomas Kiddie, of Vancouver—one of the first operators of the Van Anda camp—the molybdenite is somewhat more scaly, and occurs particularly in a zone of felsite, 6 to 8 feet wide, but does not appear in the granite footwall.

Dr. G. M. Dawson mentions the occurrence of molybdenite in the vein of the Malaspina copper mine, Texada island.[1]

VANCOUVER ISLAND.

Several localities are known for molybdenite on Vancouver island, but the information is very indefinite, and none of the deposits were examined, as there was no suggestion that they were of probable economic value.

Dr. G. M. Dawson stated that he had seen specimens of molybdenite from the 'upper part of Cowichan river.'

In 1897 Messrs. Jones and Stark, of Wellington, B.C., sent to the museum of the Geological Survey, specimens of molybdenite from the Marguerite Evangeline and Josephine claims, north side of Mount Buttle, about 5 miles north of Cowichan lake, Vancouver island.[2]

In the mineral collection of the Mines Department, Victoria, there are specimens of fine grained molybdenite from Quatsino arm, northern Vancouver island.

From conversations with those acquainted with the mining development of Vancouver island, it appears that molybdenite is of frequent occurrence, but that up to the present it has not been regarded as economic and no general record of molybdenite-bearing deposits has been prepared.

COAST REGION.

Along the channel between Vancouver island and the mainland, molybdenite has been discovered in the following localities:—

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[1] G. M. Dawson, Report, Geological Survey, p. 157 R, 1888.

[2] G. M. Dawson, Report, Geological Survey, p. 122 A, 1897.

(*a*) Knight inlet—Reported by Dr. G. M. Dawson.[1]

(*b*) Cortez island—On the point east of Carrington bay. Small quantities of quartz veins.[1]

(*c*) Jervis inlet,[1] Salmon arm—Molybdenite associated with copper ores.

(*d*) Lyon creek[2]—About 10 miles from North Vancouver, molybdenite associated with copper ores.

(*e*) Near the head of the North arm, Burrard inlet, some 2 miles up the valley of a small stream, four claims were taken up for molybdenite and are now held by Capt. W. H. Soule, J. P. Murphy, R. L. Brown, N. Lougheed, and A. McKelvie, of Vancouver. The molybdenite, which is of a fine granular type, is said to occur in a quartz vein 14″ wide, in a country rock of granite. These claims were taken up about five years ago. No attempt to mine the ore has been made, though small samples have been shipped to New York and Liverpool. A. C. Hirschfield, Vancouver, could give additional information. Other deposits of a similar nature occur near the above. Mr. Gideon Bower, of Vancouver, is interested in some which are 1½ miles from the shore, on a steep mountain side opposite Croker island.

A sample from one of the veins, sent me by Mr. Bower, assayed in the laboratory of the Mines Branch, gives the following result:—

Molybdenum.	0·86 per cent.
Copper	0·11 "
Gold.	trace.

(*f*) Mr. Thomas Kiddie, M.E., of Vancouver, showed the writer some specimens of scaly molybdenite which were given to him, and said to come from some of the claims of the Engineer group, Atlin district. As these claims carry free milling gold, it is probable that the molybdenite occurs in quartz veins. No information as to the economic value of the molybdenite was obtainable.

INTERIOR.

Gnawed Mountain, Ashcroft Mining Division.

On Gnawed mountain, some 25 miles from Ashcroft, and about half that distance from Spatsum station, on the Canadian Pacific railway, there are a number of claims valued for copper. On the claims of the Tamarack group the copper ore is principally chalcopyrite, with a subordinate amount of malachite or green copper ore near the surface. These copper deposits appear to be impregnations along parallel joint planes running east and west in the grey granitic rock of the mountain. In most of them a little molybdenite is found, but in this regard the Tamarack claim differs from the rest, in that it was first valued for molybdenite. In the other claims of this group the molybdenite is present in only very small proportions. Occasionally, quartz veins carry copper ore, and this is particularly true in some of the Tamarack workings. The molybdenite forms very showy surfaces of fine grained mineral, particularly on cracks and joints, but the thickness is quite insignificant. In other instances the molybdenite occurs as a black, brecciated fault rock, occasionally 1" in thickness, with quartz fragments and a cement of molybdenite. Very rarely is the molybdenite found in small scaly masses completely enclosed in the quartz. Molybdite, the yellow oxide, occurs as an alteration product from the sulphide.

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[1] G. M. Dawson, Report, Geological Survey, p. 157R. 1888.
[2] O. E. LeRoy, New Westminster and Nanaimo, Geological Survey, 1908.

In the vicinity of the veins and impregnation zones the granite rock has been changed into a fine grained soft scaly rock composed almost entirely of mica and quartz, resembling greissen, which is frequently associated with deposits of tin.

A sample of the molybdenum bearing ore from the Tamarack mine assayed in the laboratories of the Mines Branch gave the following result:

Molybdenum..	2·55 per cent.
Copper..	0·50 "
Bismuth..	nil.
Gold..	nil.

Some years ago, the operators shipped a ton of their best molybdenite to a firm in Pennsylvania, but the result was not encouraging. The product shipped has not been concentrated. Owing to the hardness of the quartz gangue, the almost amorphous structure of most of the molybdenite, and the presence of considerable copper, it does not seem probable that the Tamarack claim will become a molybdenite producer.

The proprietors of the claims comprised in the Tamarack group are Messrs. Sanson and Ward, of Ashcroft.

Grande Prairie, Kamloops Mining Division.

Many years ago, specimens of molybdenite from the Grande Prairie region were forwarded to the museum of the Geological Survey by Mr. McEvoy, then on the staff of the survey.[1] The region referred to was 3 miles west of Grande Prairie, which lies in the Kamloops mining division, and is situated about 18 miles south of Ducks station on the Canadian Pacific railway. This location was visited, and a number of pits were found, one of them an inclined shaft about 25 feet deep to the surface of the water. The pits are on what was formerly known as the Key claim, in which James Stuart, of Grande Prairie, is said to be interested.

The country rock is largely granite in character, but the mountain is too deeply covered with waste to be readily examined. From an examination of the pits and rock dump it is readily concluded that the ore bodies—a little chalcopyrite and molybdenite—are in some respects similar in origin to those observed on Texada island. Sedimentary rocks have been altered by igneous intrusion, and along the contact deposits carrying copper and molybdenite have been formed. Besides the grey granitic intrusion the rock types are principally marble, red brown garnet rock, and very fine grained flinty rock, a metamorphosed impure lime sediment. In the Texada copper mines these latter types are known as felsites.

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[1] Hoffmann, Report, Geological Survey, p. 14 R, 1859.

The molybdenite is almost entirely confined to quartz stringers in the contact zone. It is scaly, but there does not appear to be evidence at present of any economic quantity. The same applies to the copper values in the ore. It is stated that this claim has been abandoned. The irregular character of the Texada deposits suggests that this claim might well reward a moderate exploration, either for molybdenite or copper. Assayed in the laboratories of the Mines Branch, ore from this deposit gave the following result:—

Molybdenum	3·61 per cent.
Copper	trace.
Gold	nil.

The Silver Lead Region, Slocan and Trout Lake.

In the Trout Lake mining division molybdenite has been known for some time: where it occurs in association with the silver lead zinc ores in quartz veins. This occurrence was first noted by Mr. R. W. Brock, of the Geological Survey, who was, at the time, engaged in geologically investigating that district.[1]

Molybdenite occurs very sparingly in the veins of the Copper Chief, together with sulphides of lead and zinc in quartz veins which are nearly horizontal. The country rock is a grey schist almost vertical. Mr. Brock states that the Ruffled Grouse and Willow Grouse claims carry molybdenite, but as these have not been in operation for some time it was not possible to obtain any additional information when in the region. Those who worked in the Lucky Boy state that, molybdenite was occasionally observed when the mine was in operation.

In 1898, a claim was staked by T. R. Davie to the south of the Lucky Boy. This claim was named the Molybdenum in reference to the occurrence there of molybdenite. The Molybdenum has been abandoned and it is now difficult to find the pits made by Captain Davie and his associates.

All of these claims lie about 3 miles west of Trout Lake city, on the north slope of the hill to the south of Trout creek.

Molybdenite has been reported from Wilson creek, which flows into Slocan lake near Roseberry.[2]

Trail Creek Mining Division.

Molybdenite has been observed in several of the mines and prospects in the vicinity of Rossland. In the Centre Star and War Eagle it is occasionally met with, where it is very fine grained, and usually forms very thin layers along joint planes. The quantity is quite insignificant. Molybdenite has also been observed on the Deer Park and Novelty claims.

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[1] Bell, R., Geological Survey, Summary Report, p. 71 A, 1903.
[2] Bell, R., Geological Survey, Summary Report, p. 438 A, 1903.

In the Giant mine, which was first worked in 1900, the chief sulphides are pyrrhotite and molybdenite, with subordinate amounts of arsenopyrite and smaltite. The ore carried, as shipped, from $20 to $25 of gold to the ton. From information from Mr. M. E. Purcell, who was at one time in charge of the Giant, it is learned that no values in copper were returned from the smelter. The molybdenite does not appear to have been utilized, and no assays showing the percentage of molybdenum contained in the ore shipped are obtainable. The gold values are largely carried in the molybdenite.

The molybdenite is very fine grained—almost amorphous—and in consequence would not lend itself to the same method of concentration which would be successful with some of the scaly varieties of this ore. The ore body is very irregular, occurring in the form of impregnations from more or less vertical joints in a hard flinty rock, apparently an altered impure limestone, a type of hornfels. The altered rock is almost horizontal, and is intersected by dykes of greyish porphyritic rock, possibly camptonite.

The Giant, which is now idle, is one of the most encouraging deposits for molybdenite in the Province. Farther up the hillside lies the Novelty, which Mr. Purcell informs me is in many respects similar to the Giant.

A sample of the Giant ore such as might be regarded as valuable, particularly for the molybdenum contained, was assayed in the laboratories of the Mines Branch, giving the following result:—

Molybdenum	11·6 per cent.
Copper..	nil.
Gold..	3·39 ozs. per ton.

Nelson Mining Division.

In the bed of the Kootenay river, near the bridge on which the Canadian Pacific railway crosses, some 4 miles west of Nelson, pegmatitic quartz veins carrying coarse scaly molybdenite intersect grey hornblende biotite granite. Some of these veins are from 1 to 2 feet across, but only the veins a few inches in thickness appear to be rich in molybdenite. So far as could be learned, these veins have not been followed beyond the immediate vicinity of the river bed, and no development work has been attempted.

Molybdenite, and the yellow oxide—molybdite—have been recently discovered in quartz veins on Bear creek, a tributary of Sheep creek, 8 miles from Salmo.

Similkameen Mining Division.

According to a recent report by Mr. Charles Camsell,[1] molybdenite is of frequent occurrence in the Similkameen region, particularly at Independence camp and on Champion creek, in which latter location it forms a contact deposit between limestone and a gneissoid granite. The mineral sometimes forms flakes, and is accompanied by a series of minerals which are frequently found in metamorphosed limestone, such as garnet, epidote, pyrite, and blende. While some claims have been staked specially for molybdenite, Mr. Camsell is doubtful as to their economic value, owing to the difficulties connected with the concentration of molybdenite.

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[1] Camsell, Charles, Summary Report, Geological Survey, 1909, p. 115.

Fort Steele Mining Division.

Some 20 miles west of Marysville, in a bluish quartzite, numerous quartz veins occur, and some of them carry a very fine grained type of molybdenite in promising proportions. The writer did not personally examine the deposits, but is indebted to Messrs. Joseph Ryan and W. A. Wells, of Cranbrook, for information. The claims known as Sunnyside I and II, and Sunset, are of particular interest for the molybdenite content. On the surface where the molybdenite has weathered, the yellow oxide—molybdite—takes its place. Pyrrhotite and chalcopyrite accompany the molybdenite.

OTHER MOLYBDENITE OCCURRENCES.

For many years molybdenite was regarded as a very rare mineral and at that time it was worth several dollars per pound. Under such circumstances it was natural for geologists and explorers to call attention in their reports to the discovery of even very minute proportions of this mineral. It thus happens, that in the geological and mining literature of Canada, there are many references to molybdenite which are not dealt with in this report. In some instances the deposits are too remote to be visited, or the information too vague to make it possible to find them without prospecting the country anew; or lastly, because the deposits were really mineralogical curiosities with little to recommend them in an economic way.

The additional localities contained in the following list may be useful, especially as it directs the reader to the source of information:

No.	Locality	Work where cited.
1	Anstruther township, Ont.	Report, Bureau of Mines, Ont., Vol. XII.
2	Bagot township, Ont.	" Geological Survey of Canada, Vol. IV.
3	Belmont township, Ont.	" Bureau of Mines, Ont., Vol. XII.
4	Black river, Thunder Bay district.	" Royal Commission, Ont.
5	Cross lake, Keewatin	" Geological Survey of Canada, Vol. XV.
6	Digby township, Ont	" " " Vol. VI.
7	Dungannon township, Ont	" Bureau of Mines, Ont., Vol. IX.
8	Foley township, Ont.	" " " Vol. IX.
9	Franklin territory	" Geological Survey of Canada, Vol. II.
10	Fraser river, B. C	" " " Vol. III and IV.
11	Lac des Mille Lacs, Ont	" Geological Survey of Canada, Vol. X.
12	Lillooet river, B.C	" " " Vol. III.
13	Moiybdenite lake, Algoma, Ont.	" Bureau of Mines, Ont., Vol. XIV.
14	Nipissing lake, Ont.	" Geological Survey of Canada, Vol. X.
15	Paint Hill island, Labrador	" " " Vol. XII.
16	Playgreen lakes, Keewatin	" " " Vol. XI.
17	Spuzzum creek, B.C	" " " Vol. III.
18	Terrace cove, Thunder Bay district, Ont.	" Bureau of Mines, Ont., Vol. IX.
19	Vermilion river, Algoma	" Geological Survey of Canada, Vol. V.
20	Worthington mine, Ont.	" Bureau of Mines, Ont., Vol. XIV.

GENERAL CONCLUSIONS.

It has been the endeavour of the writer to bring together in this report such information regarding the Canadian deposits of molybdenite as would be useful to those interested in their development. On this account the first part of the report contains information regarding the properties of the chief ores, their mode of occurrence, method of concentration, and value.

A large proportion of the best known deposits have been examined. Some of these are more promising than others. It is difficult to show engineers and investors these deposits owing to the long distance which it is necessary to travel. To avoid waste of time and consequent disappointment the writer submits the following list as representing the most promising deposits as they were to be seen in 1909 and 1910 when visited by him. The fact that a property is included in this list must not be understood to mean that it is certain to become a valuable mine, neither does omission from this list mean that a deposit is of little or no value. Further work may change the appearance of any deposit, and this is particularly true when referring to deposits such as those of molybdenite.

1. Aldfield township, lots 1 and 2, concession III.
2. Brougham township, lot 8, concession XI.
3. Cardiff township, lot 11, concession IX.
4. Doucet and Sweezie claim, Indian peninsula.
5. Egan township, lot 69, range IV.
6. Giant mine, Rossland, B.C.
7. Harcourt township, lots 2 and 3, concessions I and II.
8. Height of Land mine, Kewagama lake.
9. Island opposite Romaine, Lower St. Lawrence.
10. Lynedoch township, lots 4 and 5, concession VIII.
11. Ross township, lot 22, concession II.
12. Sheffield township, east half lot 5, concession XIV.

All the above deposits are described in the present report.

With regard to the location of molybdenite deposits, it may be stated that in Canada they are usually found in archæan regions, and are probably due to the influence of masses of granite. Molybdenite occurs in quartz veins, pegmatite dykes (probably connected with the granite mass), and along contact borders of granite or pegmatite with crystalline limestone. Many of the deposits of the Ottawa valley are of this type. In prospecting for molybdenite it might be profitable to keep in mind these facts regarding the nature of the country likely to contain valuable molybdenite deposits.

The present total production of molybdenum ores is quite small. If large ore bodies were available molybdenum would undoubtedly be more largely used. For certain purposes it would replace tungsten. It may be well worth remembering that at present the world market for molybdenum is limited, and consequently the prices for molybdenite prospects should be based on the probable profit to be derived by supplying the present market. Mining is frequently retarded by the excessive prices asked for undeveloped deposits.

BIBLIOGRAPHY.

In the reports of the Geological Survey, Canada, there are a great many references to the occurrence of molybdenite. For full list it will be necessary to consult these reports. Only a few of the chief sources of information are indicated in the following list:—

1. Andrews, E. C., Molybdenum, Geological Survey of New South Wales, Mineral Resources 11, Sydney, 1906.

2. Cameron, Walter E., Wolfram and Molybdenite Mining in Queensland, Department of Mines, Brisbane, 1904.

3. Hess, Frank L., Bulletin No. 340, United States Geological Survey, Washington, 1908.

4. Johnston, R. A. A., and Willimott, C. W., Bulletin on Molybdenum and Tungsten, Geological Survey of Canada, Ottawa, 1904.

5. Mills, S. Dillon, Report, Bureau of Mines, Ontario, 1902, p. 45 and following pages.

6. Mineral Industry, 1904, p. 327 and following pages.

7. Mineral Industry, 1907, p. 722 and following pages.

8. Obalski, J., Molybdenite (in Quebec) Sessional papers for the Province of Ontario, 1899.

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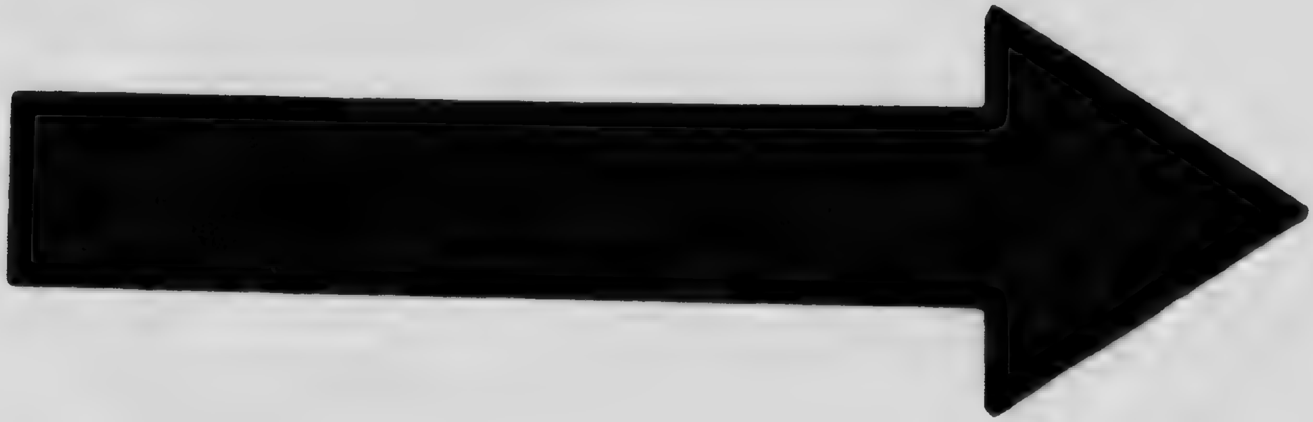

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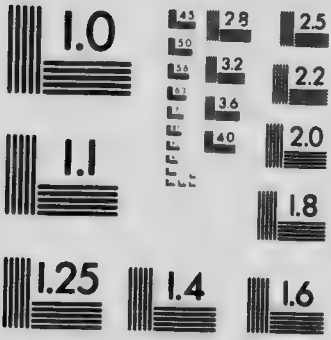

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4. Rapport de la Commission nommée pour étudier les divers procédés électro-thermiques pour la réduction des minerais de fer et la fabrication de l'acier employés en Europe. (French Edition), 1905. (Out of print.)
5. On the location and examination of magnetic ore deposits by magnetometric measurements. Eugene Haanel, Ph.D., 1904.
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12. Zinc Resources of British Columbia and the Conditions affecting their Exploitation. Report of the Commission appointed to investigate—by W. R. Ingalls, 1905.
16. Experiments made at Sault Ste. Marie, under Government auspices, in the smelting of Canadian iron ores by the electro-thermic process. Final Report on—by Eugene Haanel, Ph.D., 1907.
17. Mines of the Silver-Cobalt Ores of the Cobalt district: Their Present and Prospective Output. Report on—by Eugene Haanel, Ph.D., 1907.
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59. Chemical Analyses of Special Economic Importance made in the Laboratories of the Department of Mines, 1906-7-8. Report on--by F. G. Wait, M.A., F.C.S. (With Appendix on the Commercial Methods and Apparatus for the Analysis of Oil-shales—by H. A. Leverin, Ch.E.)
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Schedule of Charges for Chemical Analysis and Assays.

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69. Chrysotile-Asbestos: Its Occurrence, Exploitation, Milling, and Uses. Report on—by Fritz Cirkel, M.E. (Second Edition, enlarged.)

71. Investigation of the Peat Bogs, and Peat Industry of Canada, 1909-10: to which is appended Mr. Alf. Larson's Paper on Dr. M. Ekenberg's Wet-Carbonizing Process: from Teknisk Tidskrift, No. 12, December 26, 1908—translation by Mr. A. Anrep, Jr.; also a translation of Lieut. Ekelund's Pamphlet entitled 'A Solution of the Peat Problem,' 1909, describing the Ekelund Process for the Manufacture of Peat Powder, by Harold A. Leverin, Ch.E. Bulletin No. 4—by A. Anrep, Peat Expert. (Second Edition, enlarged.)

79. Production of Iron and Steel in Canada during the calendar year 1909. Bulletin on—by John McLeish, B.A.

80. Production of Coal and Coke in Canada during the calendar year 1909. Bulletin on—by John McLeish, B.A.

82. Magnetic Concentration Experiments. Bulletin No. 5—by Geo. C. Mackenzie.

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88. The Mineral Production of Canada, 1909. Annual Report on—by John McLeish B.A.

89. Reprint of Presidential address delivered before the American Peat Society at Ottawa, July 25, 1910. By Eugene Haanel, Ph.D.

90. Proceedings of Conference on Explosives.

92. Investigation of the Explosives Industry in the Dominion of Canada, 1910. Report on—by Capt. Arthur Desborough. (Second Edition.)

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102. Mineral Production of Canada, 1910. Preliminary Report on—by John McLeish, B.A.

103. Mines Branch Summary Report, 1910.

IN THE PRESS.

83. An investigation of the Coals of Canada with reference to their Economic Qualities: as conducted at McGill University under the auspices of the Dominion Government. Report on—by J. B. Porter, E.M., D.Sc., and R. J. Durley, Ma.E.

100. The Building and Ornamental Stones of Canada. Report on—by Professor W. A. Parks.

104. Catalogue of Publications of Mines Branch, from 1902 to 1911; containing Tables of Contents, and List of Maps, etc.

110. Western Portion of Torbrook Iron Ore Deposits, Annapolis county, N. S. Bulletin No. 7—by Howells Fréchette, M.Sc.

111. Diamond Drilling at Point Mamainse, Ont. Bulletin No. 3—by A. C. Lane, Ph.D., with Introductory by A. W. G. Wilson, Ph.D.

114. Production of Cement, Lime, Clay Products, Stone, and other Structural materials in Canada, 1910. Bulletin on—by John McLeish, B.A.

115. Production of Iron and Steel in Canada during the calendar year 1910. Bulletin on—by John McLeish, B.A.

116. Production of Coal and Coke in Canada during the calendar year 1910. Bulletin on—by John McLeish, B.A.

117. General Summary of the Mineral Production in Canada during the calendar year 1910. Bulletin on—by John McLeish, B.A.

118. Mica: Its Occurrence, Exploitation, and Uses. Report on—by Hugh S. de Schmid, M.E.

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91. Coal and Coal Mining in Nova Scotia. Report on—by J. G. S. Hudson.

MAPS.

6. Magnetometric Survey, Vertical Intensity: Calabogie mine, Bagot township, Renfrew county, Ontario—by E. Nyström, M.E., 1904.

13. Magnetometric Survey of the Belmont Iron Mines, Belmont township, Peterborough county, Ontario—by B. F. Haanel, B.Sc., 1905.

14. Magnetometric Survey of the Wilbur mine, Lavant township, Lanark county, Ontario—by B. F. Haanel, B.Sc., 1905

15. Magnetometric Survey, Vertical Intensity: Iron Ore Deposits at Austin brook, Bathurst township, Gloucester county, N.B.—by E. Lindeman, M.E., 1906.

33. Magnetometric Survey, Vertical Intensity: Lot 1, Concession VI, Mayo township, Hastings county, Ontario—by Howells Fréchette, M.Sc., 1909.

34. Magnetometric Survey, Vertical Intensity: Lots 2 and 3, Concession VI, Mayo township, Hastings county, Ontario—by Howells Fréchette, M.Sc., 1909.

35. Magnetometric Survey, Vertical Intensity: Lots 10, 11, and 12, Concession IX, and Lots 11 and 12, Concession VIII, Mayo township, Hastings county, Ontario—by Howells Fréchette, M.Sc., 1909.

36. Survey of Mer Bleue Peat Bog, Gloucester township, Carleton county, and Cumberland township, Russell county, Ontario—by Erik Nyström, M.E., and A. Anrep, Peat Expert.

37. Survey of Alfred Peat Bog, Alfred and Caledonia townships, Prescott county, Ontario—by Erik Nyström, M.E., and A. Anrep, Peat Expert.

38. Survey of Welland Peat Bog, Wainfleet and Humberstone townships, Welland county, Ontario—by Erik Nyström, M.E., and A. Anrep, Peat Expert.

39. Survey of Newington Peat Bog, Osnabruck, Roxborough, and Cornwall townships, Stormont county, Ontario—by Erik Nyström, M.E., and A. Anrep, Peat Expert.

40. Survey of Perth Peat Bog, Drummond township, Lanark county, Ontario—by Erik Nyström, M.E., and A. Anrep, Peat Expert.

41. Survey of Victoria Road Peat Bog, Bexley and Carden townships, Victoria county, Ontario—by Erik Nyström, M.E., and A. Anrep, Peat Expert.

48. Magnetometric Map of Iron Crown claim at Klaanch river, Vancouver island, B.C.—by Einar Lindeman, M.E.

49. Magnetometric Map of Western Steel Iron claim, at Sechart, Vancouver island, B.C.—by Einar Lindeman, M.E.

50. Vancouver island, B.C.—by Einar Lindeman, M.E.

51. Iron Mines, Texada island, B.C.—by E. H. Shepherd, C.E.

52. Sketch Map of Bog Iron Ore Deposits, West Arm, Quatsino sound, Vancouver island, B.C.—by L. Frank.

53. Iron Ore Occurrences, Ottawa and Pontiac counties, Quebec, 1908—by J. White, and Fritz Cirkel, M.E.

54. Iron Ore Occurrences, Argenteuil county, Quebec, 1908—by Fritz Cirkel, M.E.

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60. Magnetometric Survey of the Bristol mine, Pontiac county, Quebec—by Einar Lindeman, M.E.

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72. Brunner Peat Bog, Ontario—by A. Anrep, Peat Expert.

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77. Alfred Peat Bog, Ontario: Main Ditch profile—by A. Anrep.

78. Map of Asbestos Region, Province of Quebec, 1910—by Fritz Cirkel, M.E.

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95. [illegible] of Canada showing Coal Fields. (Accompanying report No. [illegible] by Dr. J. B. Porter.)

96. General Map of Coal Fields of Nova Scotia and New Brunswick. (Accompanying Report No. 83—by Dr. J. B. Porter.)

97. General Map showing Coal Fields in Alberta, Saskatchewan, and Manitoba. (Accompanying Report No. 83—by Dr. J. B. Porter.)

98. General Map of Coal Fields in British Columbia. (Accompanying Report No. 83—by Dr. J. B. Porter.)

99. General Map of Coal Field in Yukon Territory. (Accompanying Report No. 83—by Dr. J. B. Porter.)

106. Austin Brook Iron Bearing district, Bathurst township, Gloucester county, N.B.—by E. Lindeman, M.E.

107. Magnetometric Survey, Vertical Intensity: Austin Brook Iron Bearing district—by E. Lindeman, M.E.

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113. Holland Peat Bog, Ontario—by A. Anrep, Peat Expert.